

APPENDIX B

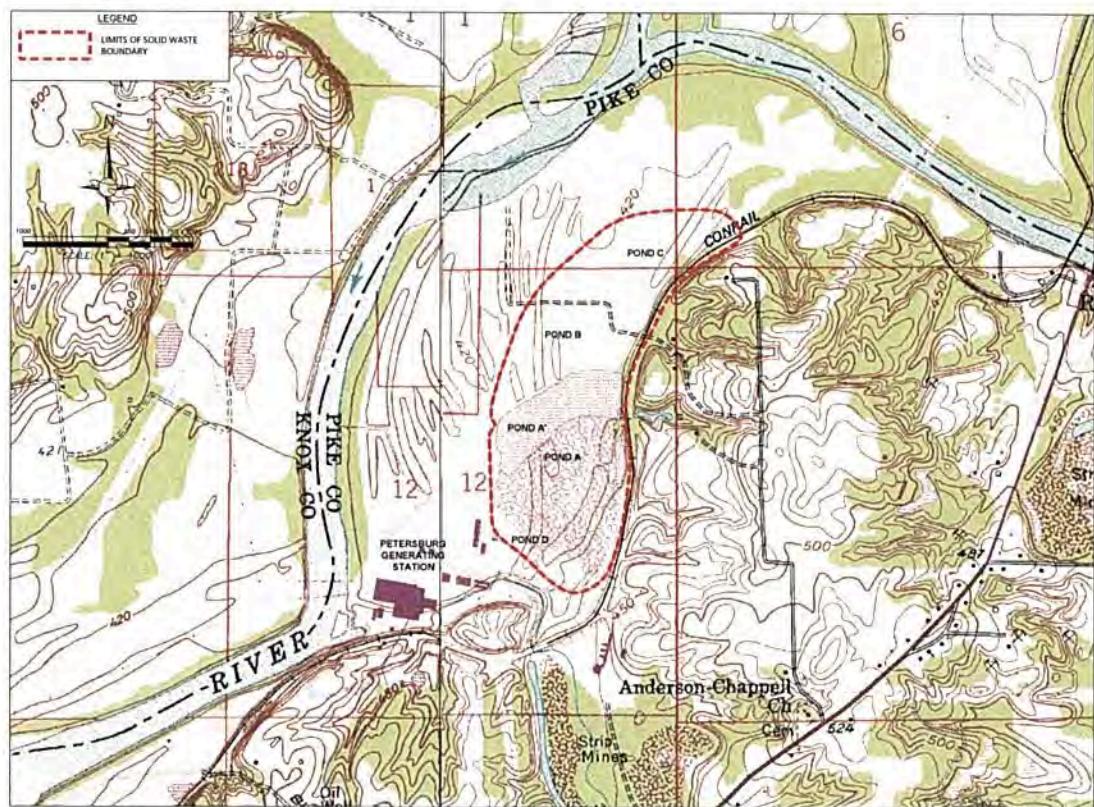
Final Closure of Ash Pond B

APPENDIX B-1

Construction Drawings, Issued for Bid May 5, 2017

FINAL CLOSURE OF ASH POND B PETERSBURG GENERATING STATION PETERSBURG, INDIANA

INDIANAPOLIS POWER □ LIGHT



SITE VICINITY MAP

INDEX	
SHEET NO.	DESCRIPTION
1	TITLE AND INDEX SHEET
2	LEGEND, ABBREVIATIONS AND NOTES
3	EXISTING CONDITIONS : 2016 AERIAL PHOTOGRAPHY
4	EXISTING CONDITIONS : TOPOGRAPHIC MAPPING
5	FINAL COVER SUBGRADE PLAN
6	FINAL COVER GRADING PLAN
7	LOCATION OF SURFACE WATER CONTROL STRUCTURES
8-9	CROSS SECTIONS
10-15	TYPICAL DETAILS

OWNER:
IPL PETERSBURG GENERATING STATION
6925 NORTH STATE ROAD 57
PETERSBURG, INDIANA

PREPARED BY:
ATC GROUP SERVICES LLC
7988 CENTERPOINT DRIVE, SUITE 100
INDIANAPOLIS, INDIANA □ 6256

Project Number
1701/00000000
Drawing No.
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Scale
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Sheet
1 of 15

Company Name
IPL PETERSBURG GENERATING STATION
6925 NORTH STATE ROAD 57
PETERSBURG, INDIANA
ISSUED FOR BID MAY 5, 2017

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ATC

Drawing Title
TITLE AND INDEX SHEET
FINAL CLOSURE OF ASH POND B
PETERSBURG GENERATING STATION

Sheet
1

ABBREVIATIONS

CURTAILMENT/ ACRONYM	DESCRIPTION
	AT
APPROX.	APPROXIMATE
CBR	CLOSURE BY REMOVAL
CCR	COAL COMBUSTION RESIDUALS
CCR RULE	EPA FINAL RULE FOR DISPOSAL OF COAL COMBUSTION RESIDUALS FROM ELECTRIC UTILITIES
CIP	CLOSURE IN PLACE
CL	CENTER LINE
CLR	CLEARANCE
DIA	DIAMETER
EA	EACH
EL, ELEV	ELEVATION
EPA	UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
FSS	FIXATED SCRUBBER SLUDGE
FT	FEET
HDPE	HIGH DENSITY POLYETHYLENE
HORIZONTAL	HORIZONTAL
INVERT	INVERT
LF	LINEAR FEET
MAX	MAXIMUM
MIN	MINIMUM
NQ	NUMBER
NTS	NOT TO SCALE
OD	OUTER DIAMETER
OH	OVERHEAD
OZ	OUNCES
SDR	STANDARD DIMENSION RATIO
SECT	SECTION
SQ	SQUARE
SR	STATE ROUTE
STA	STATION OR STATIONING
STD	STANDARD
SY	SQUARE YARDS
TEMP	TEMPORARY
TYP	TYPICAL
WS	WATER SURFACE

TOPOGRAPHIC NOTES:

2013 LIDAR CONTOURS:

THIS MAPPING HAS BEEN PRODUCED ACCORDING PROCEDURES THAT HAVE BEEN DEMONSTRATED TO COMPLY WITH NATIONAL MAP ACCURACY STANDARDS (NMAS) FOR A HORIZONTAL SCALE OF 1"=100' AND A CONTOUR INTERVAL OF TWO FEET. MAPS SHOULD BE CHECKED FOR HORIZONTAL AND VERTICAL ACCURACY PRIOR TO USE. VERTICAL DATUM BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988. HORIZONTAL DATUM BASED ON INDIANA STATE PLANE COORDINATE SYSTEM, EAST AND WEST ZONES, NAD83 2011, 2012 & 2013 CLASSIFIED LIDAR POINT CLOUD DATA IN LAS FILE FORMAT, VERSION 1.2 STATE OF INDIANA.

2015 SURVEY CONTOURS:

BATHYMETRY SURVEY BY OTHERS

7.5 MINUTE (1:24,000) USGS QUADRANGLE MAPS:

1989 SANDY HOOK, IN
1989 MONROE CITY, IN

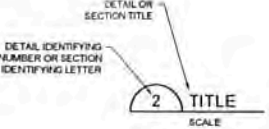
AERIAL PHOTOGRAPHY:

2016 INDIANA OFFICE OF INFORMATION TECHNOLOGY

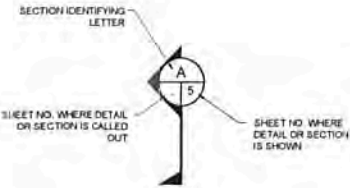
LEGEND:

SYMBOL	DESCRIPTION
	LANDFILL MONITORING WELL
	ASH POND SYSTEM GROUNDWATER MONITORING WELL
	LIMITS OF BATHYMETRY SURVEY
	2015 BATHYMETRY CONTOURS
	2013 INDIANA LIDAR CONTOURS
	PROPERTY BOUNDARY
	PRIMARY ACCESS ROUTE
	SECONDARY ACCESS ROUTE
	APPROXIMATE LIMITS OF SOLID WASTE BOUNDARY
	TEMPORARY ANCHORED EDGE OF GEOSYNTHETIC
	PROPOSED FINAL COVER SUBGRADE
	PROPOSED TOP OF FINAL COVER
	TEMPORARY CONTOURS
	POND
	WETLAND MITIGATION AREA
	APPROXIMATE LIMITS OF COMPOSITE FINAL COVER WITH SMOOTH GEOMEMBRANE
	APPROXIMATE LIMITS OF COMPOSITE FINAL COVER WITH TEXTURED GEOMEMBRANE
	SALT FENCE
	18 IN. DIA. SOLID WALL PIPE WITH 2.30 IN. DIA. PIPE INLETS
	18 IN. DIA. PIPE
	8 IN. DIA. TOE DRAIN PERFORATED PIPE
	8 IN. DIA. TOE DRAIN SOLID WALL
	2.0 FT. EROSION CONTROL BERM
	RIPRAP SPLASH PAD
	RIPRAP PLUNGE POOL
	RIPRAP OPEN CHANNEL DOWN DRAIN
	RIPRAP VALLEY DRAIN
	PIPE DOWN DRAIN
	SOLID DRAINAGE PIPE
	STREAM
	TREE LINE
	ROAD ACCESS
	FENCE LINE
	RAILROAD TRACK
	PIPE LINE
	RETAINING WALL
	GUARD RAIL
	POLE
	LIGHT POLE
	OVERHEAD ELECTRIC LINE AND TRANSMISSION TOWER
	EXISTING CATCH BASIN
	DRAINAGE AREA NUMBER WITH ACREAGE

DETAILING □ SECTION IDENTIFICATION NOMENCLATURE



DETAIL NUMBER AND DETAIL TITLE



SECTION REFERENCE ON SHEET WHERE SECTION IS CALLED OUT

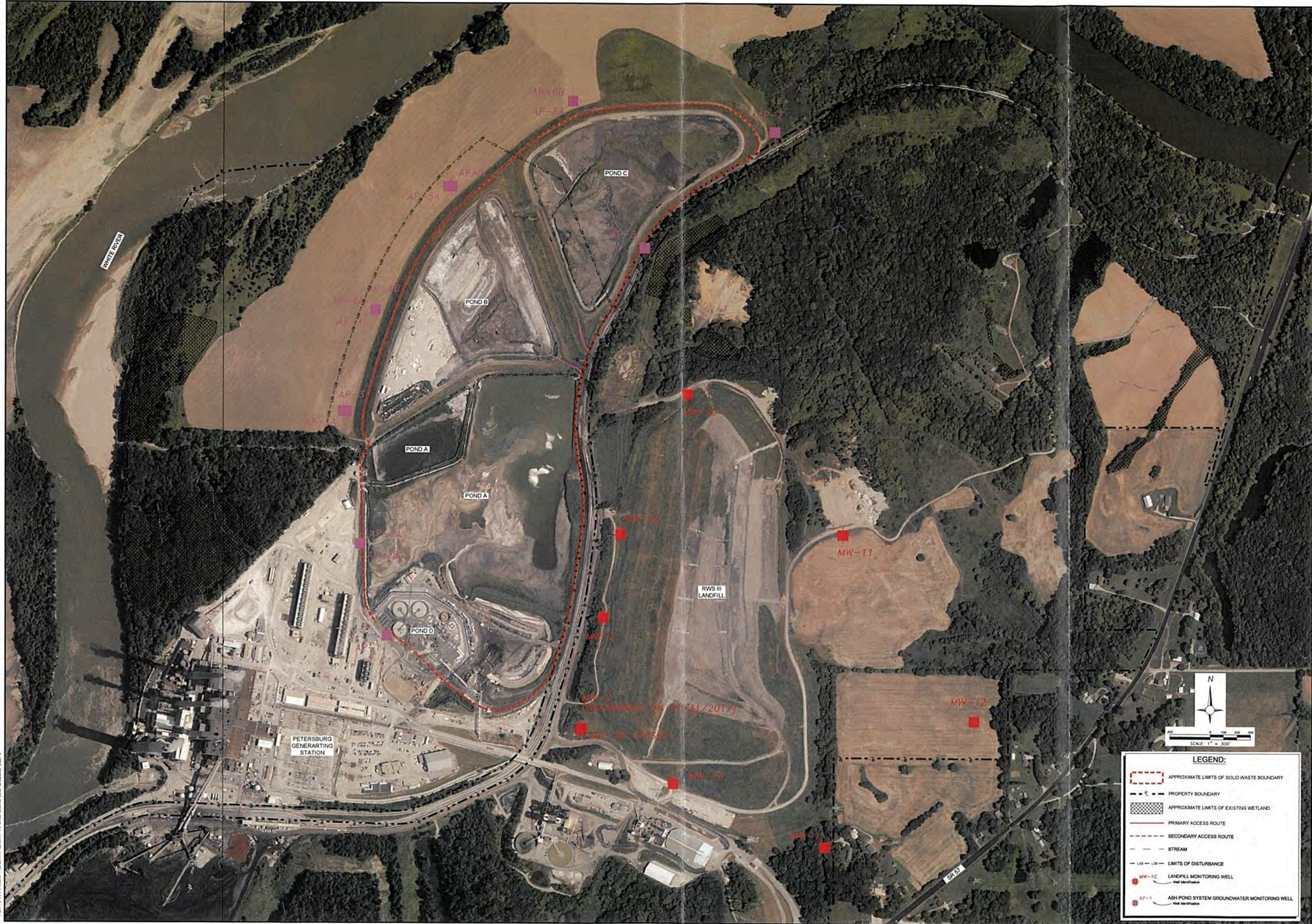
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2 of 2

Company Name:
IPL PETERSBURG GENERATING STATION
6925 NORTH STATE ROAD 57
PETERSBURG, INDIANA
ISSUED FOR BID MAY 5, 2017

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Drawing Title:
LEGEND, ABBREVIATIONS AND NOTES
FINAL CLOSURE OF ASH POND B
PETERSBURG GENERATING STATION

Sheet:
2



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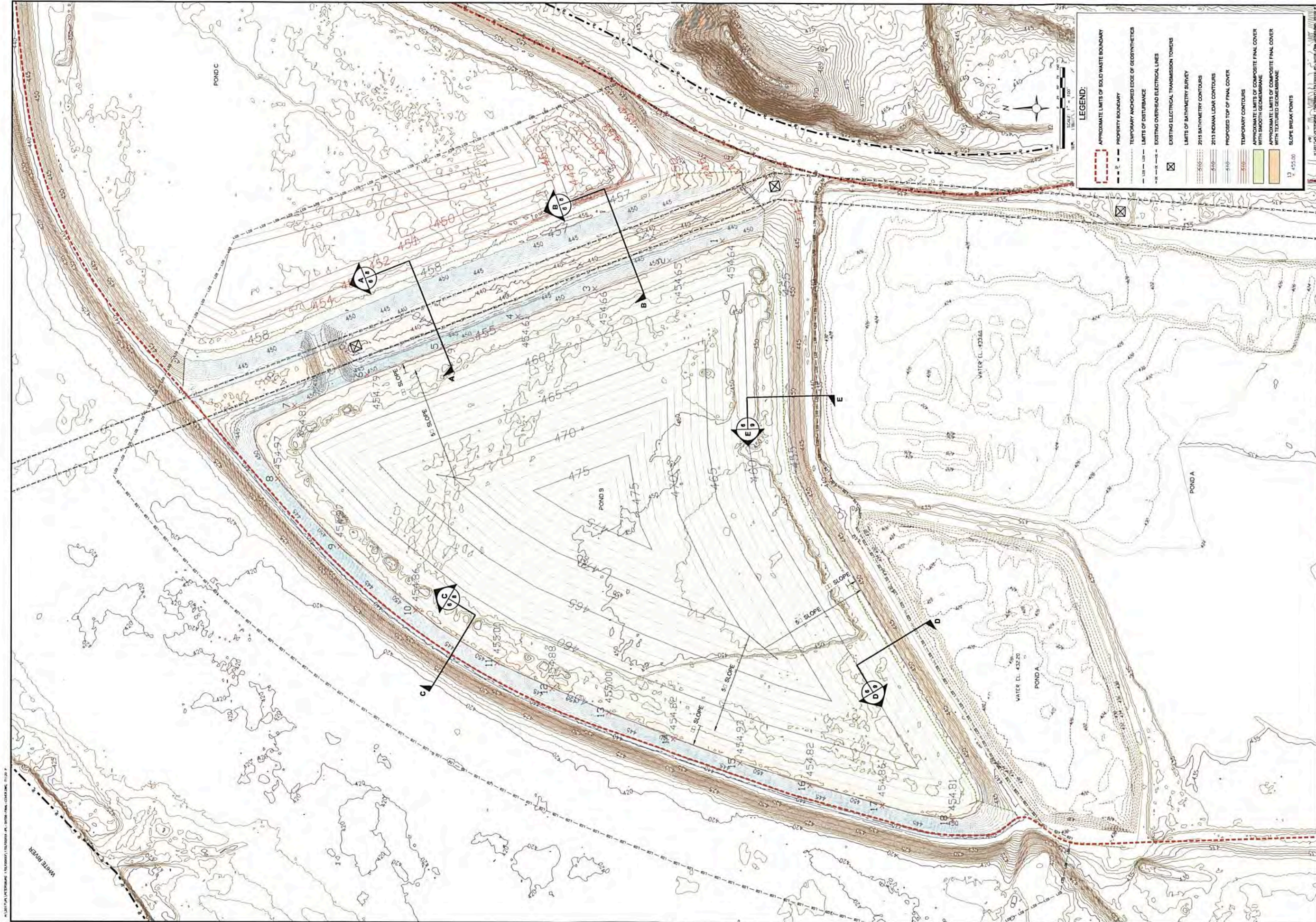
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EXISTING CONDITIONS - 2016 AERIAL PHOTOGRAPHY
FINAL CLOSURE OF ASH POND B
PETERSBURG GENERATING STATION

3

Company Name:
IPL PETERSBURG GENERATING STATION
1000 STATE ROAD 57
PETERSBURG, INDIANA

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5/17
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FINAL COVER GRADING PLAN
FINAL CLOSURE OF ASH POND SYSTEM B
PETERSBURG GENERATING STATION

6

Company Name:
IPL PETERSBURG GENERATING STATION
6925 NORTH STATE ROAD 57
PETERSBURG, INDIANA

Project No.:
1705F00295

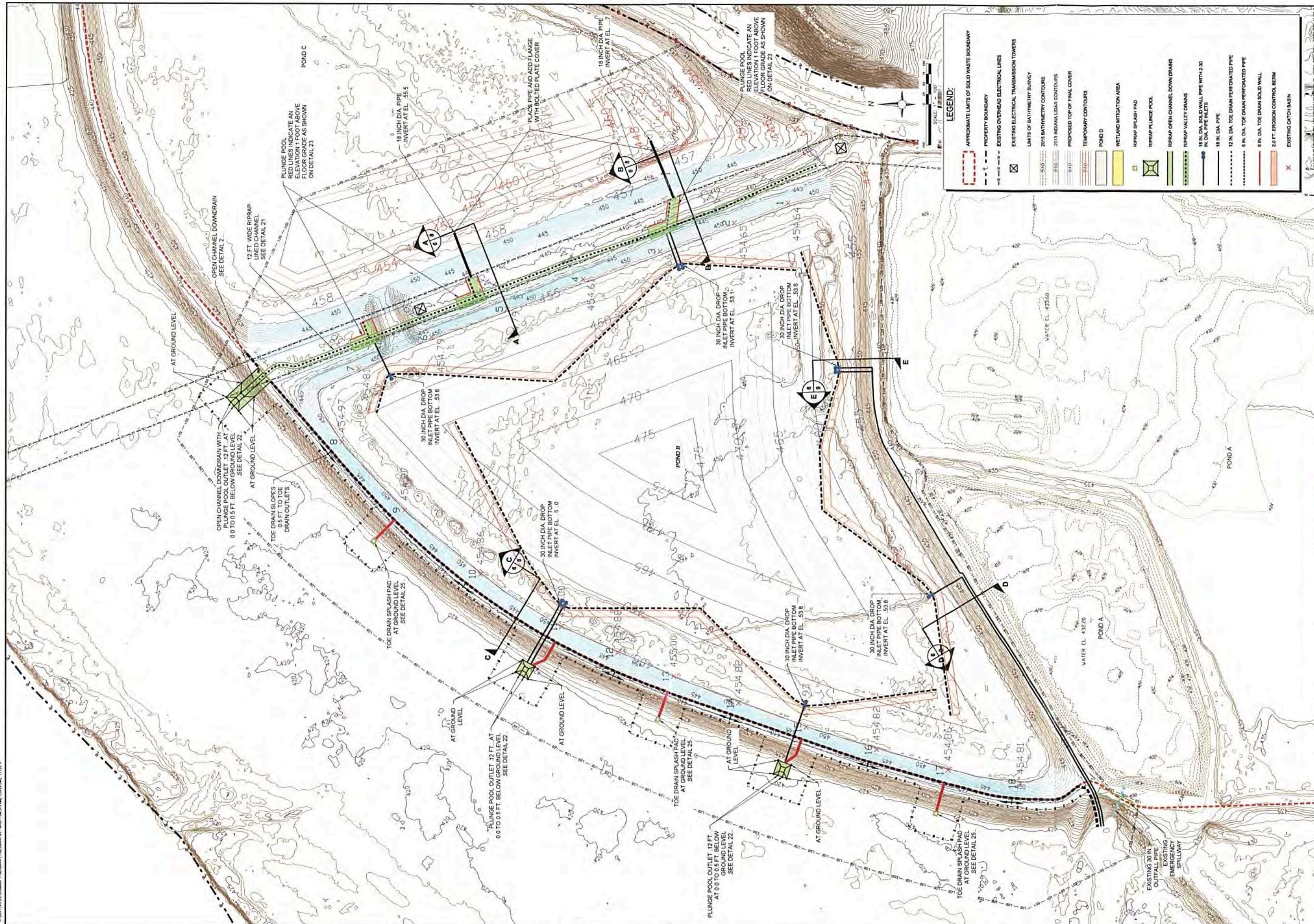
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Issue:
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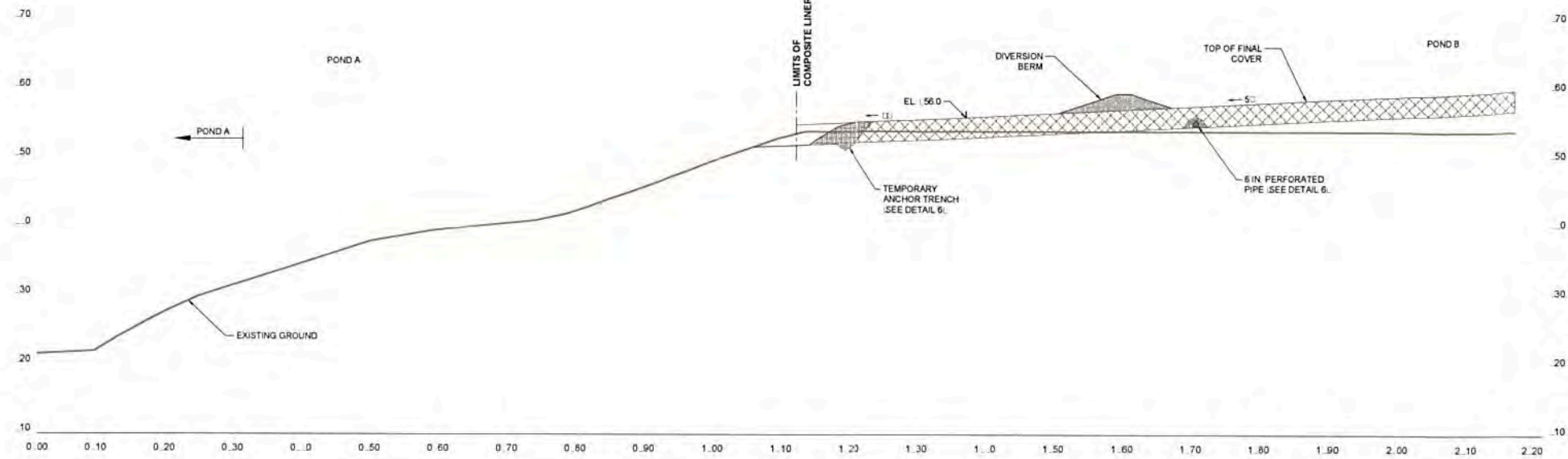
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ISSUED FOR BID MAY 5, 2017



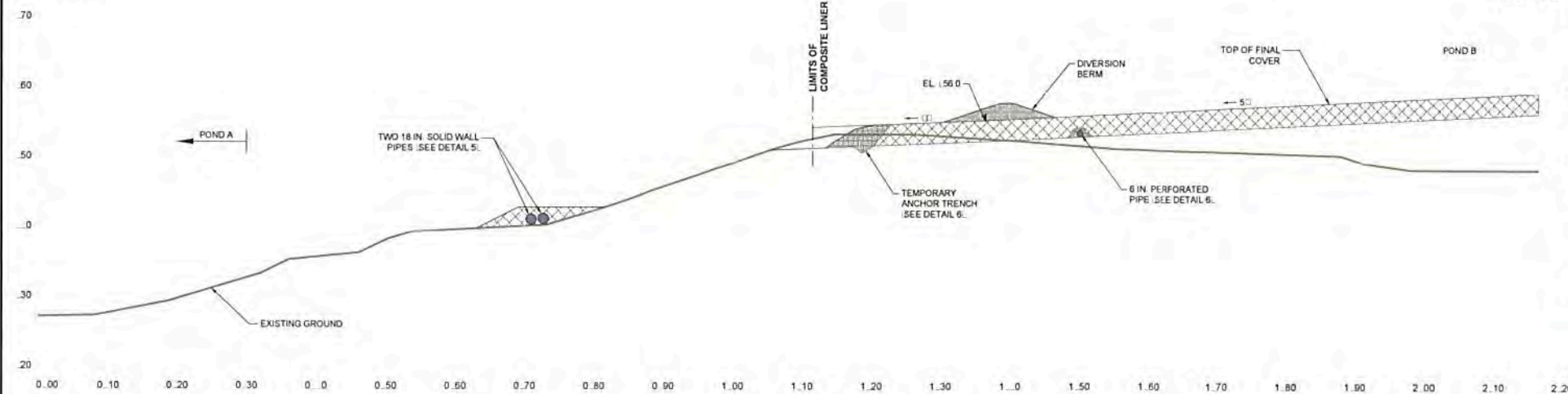
ATC		ATC GROUP SERVICES LLC 788 CENTERPOINT DR. SUITE 100 INDIANAPOLIS, IN 46258 PHONE +1 317 848 4880 FAX +1 317 848 4278 WWW.ATCGROUPSERVICES.COM	
LOCATION OF PROPOSED WATER CONTROL SURFACE STRUCTURES FINAL CLOSURE OF ASH POND B PETERSBURG GENERATING STATION		ISSUED FOR BID MAY 5, 2017	
Drawing Title		Revision	
Sheet		1/10/17 - NO. 1 - REVISE TOE DRAIN DETAIL LABEL, ADD 'EXISTING' TO LABEL FOR EXISTING SPILLWAY AND 30 IN. PIPE CHANGED DIVERSION BERM PIPE LINE TYPE AND SIZE	

D
SOUTH



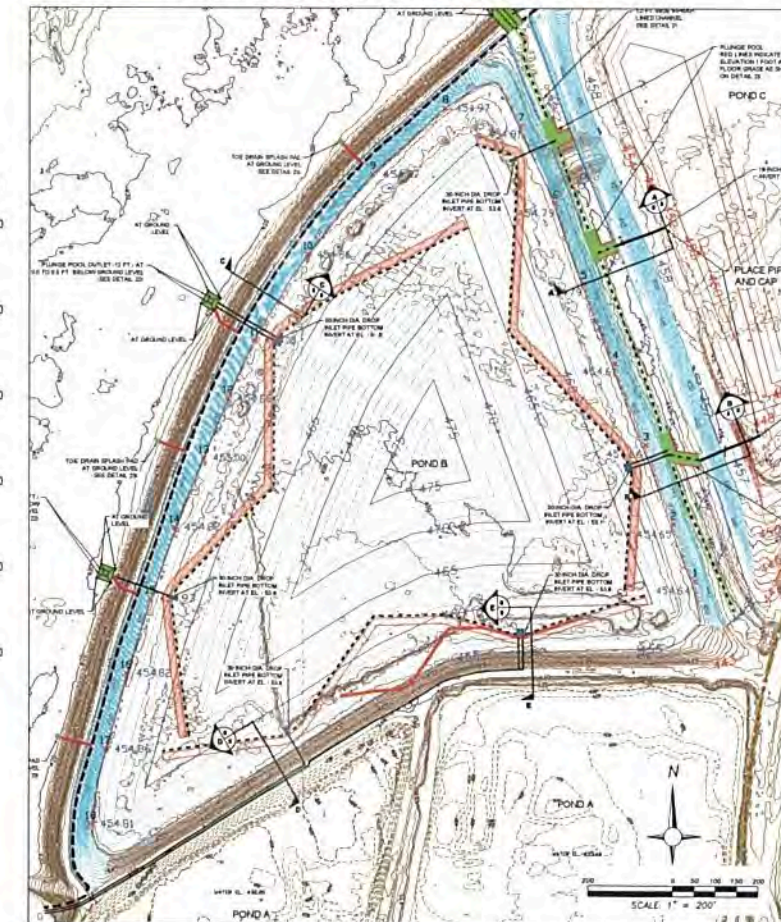
CROSS SECTION D

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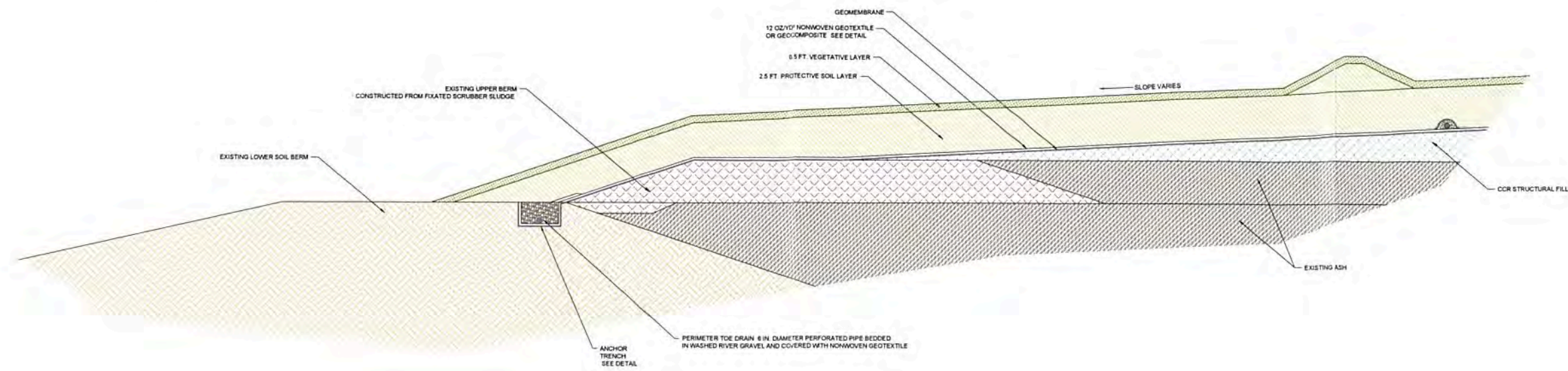


CROSS SECTION E

CROSS SECTION LOCATION MAP

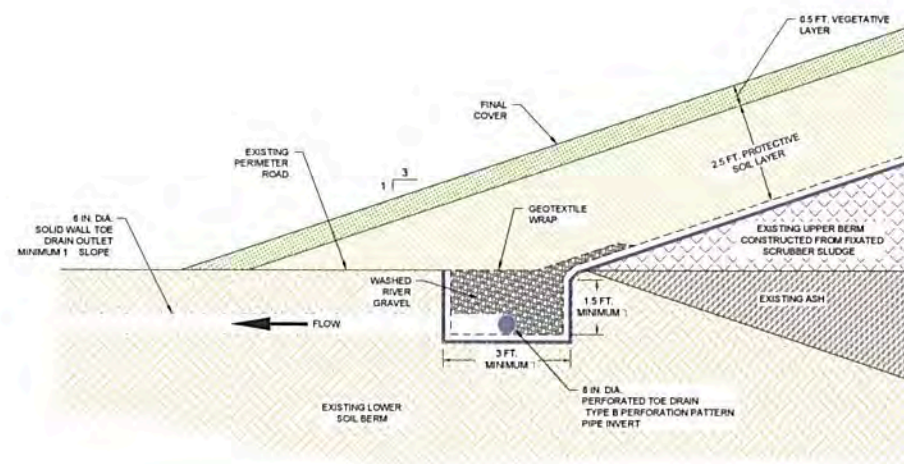


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Company Name: IPL PETERSBURG GENERATING STATION 6925 NORTH STATE ROAD 57 PETERSBURG, INDIANA	
ATC GROUP SERVICES LLC 7888 CENTERPOINT DR. SUITE 100 INDIANAPOLIS, IN 46256 PHONE +1 317 449 4880 FAX +1 317 449 4278 WWW.ATCGROUPSERVICES.COM	
ATC	
Drawing Title: CROSS SECTIONS C AND D FINAL CLOSURE OF ASH POND B PETERSBURG GENERATING STATION	
Sheet: 9	

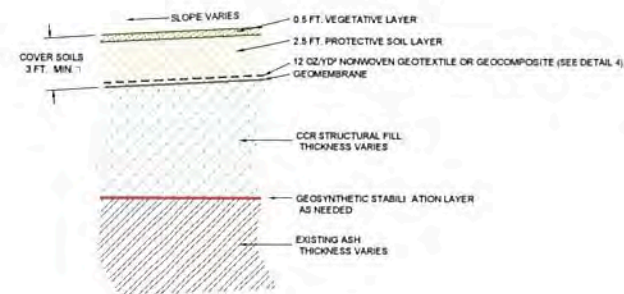


1 TYPICAL CROSS SECTION OF FINAL COVER
ASH PONDS B AND C

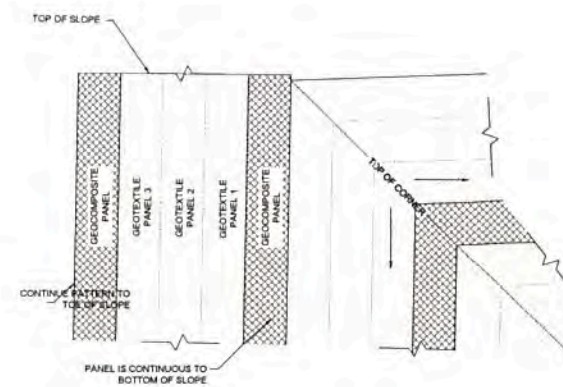
NOT TO SCALE












2 PERIMETER TOE DRAIN OUTLET
NOT TO SCALE

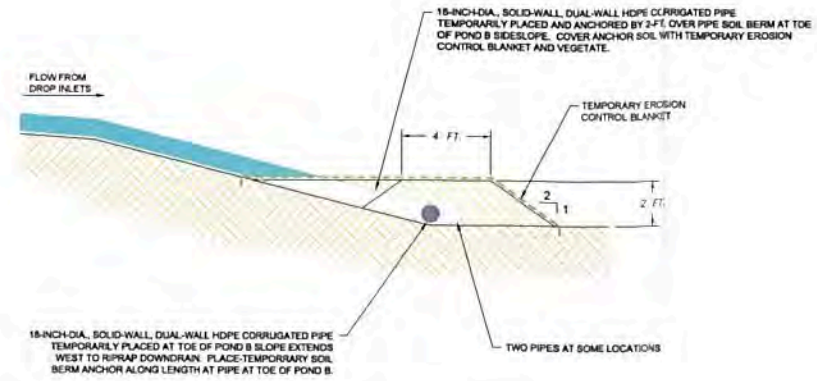
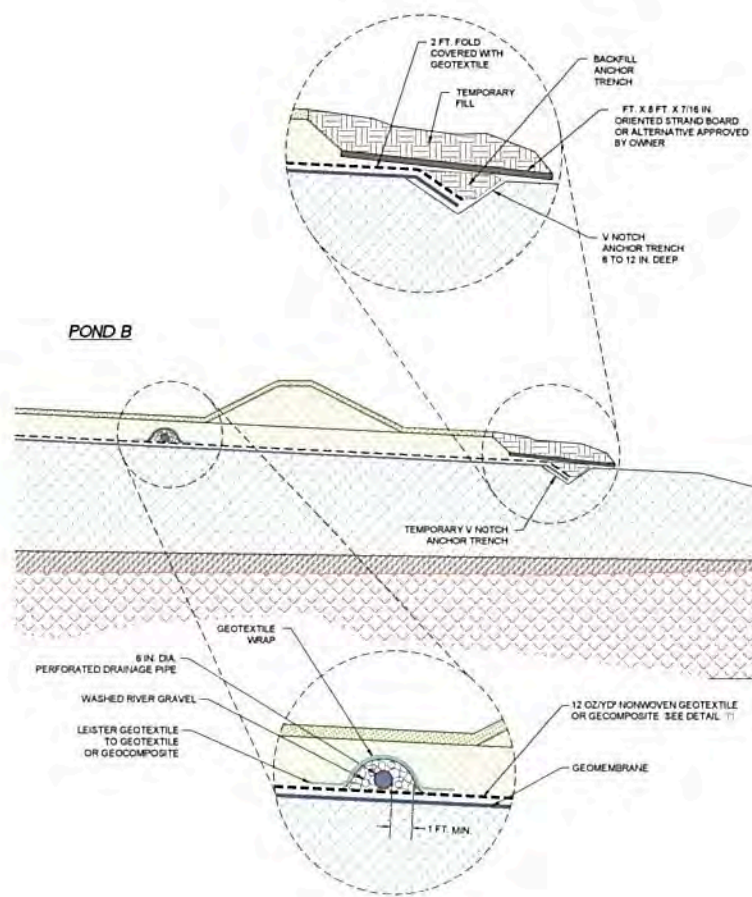


3 GEOCOMPOSITE FINAL COVER OPTION
NOT TO SCALE



GEOTEXTILE AND GEOCOMPOSITE PANEL LOCATIONS
 NOT TO SCALE

- LEGEND:**
- | | |
|---|-----------------------|
|  | ASPHALT PAVEMENT |
|  | REFRAP |
|  | WASHED RIVER GRAVEL |
|  | GCR STRUCTURAL FILL |
|  | EXISTING ASH |
|  | EXISTING LOWER BERM |
|  | EXISTING UPPER BERM |
|  | PROTECTIVE SOIL LAYER |
|  | VEGETATIVE LAYER |



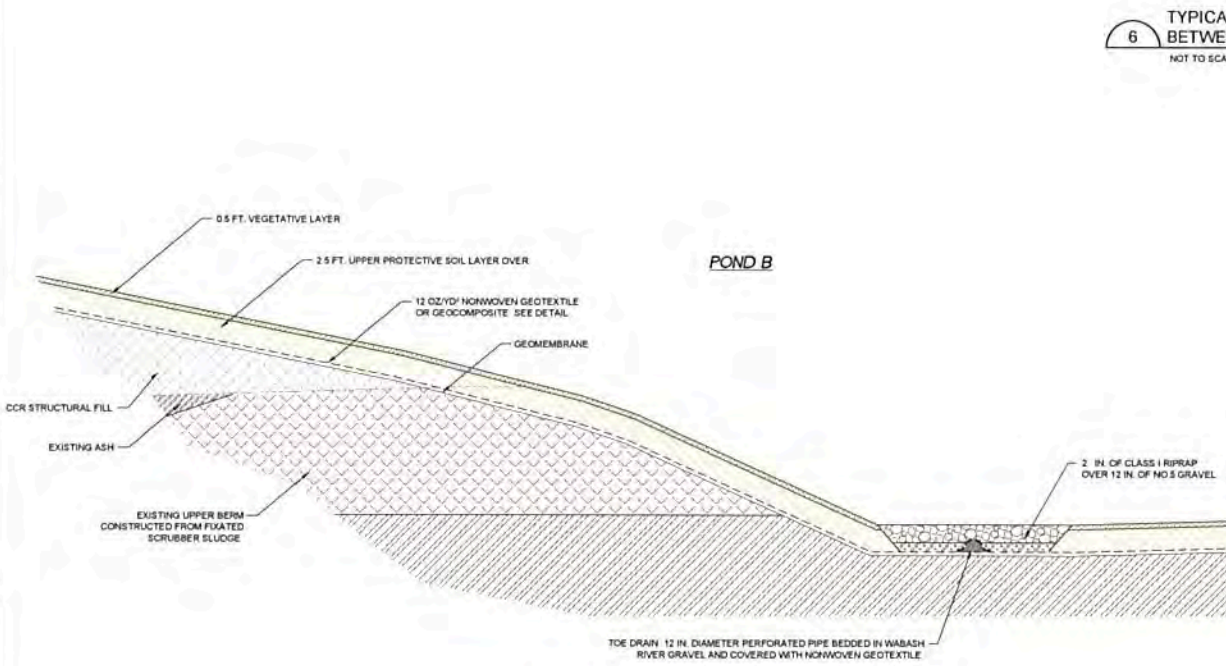
5 TEMPORARY DOWNDRAIN OUTLET PIPES
NOT TO SCALE

POND A

TEMPORARY 18 IN. DIAMETER
SOLID PIPE WITH SOIL COVER
SEE DETAIL 5

POND B

POND C

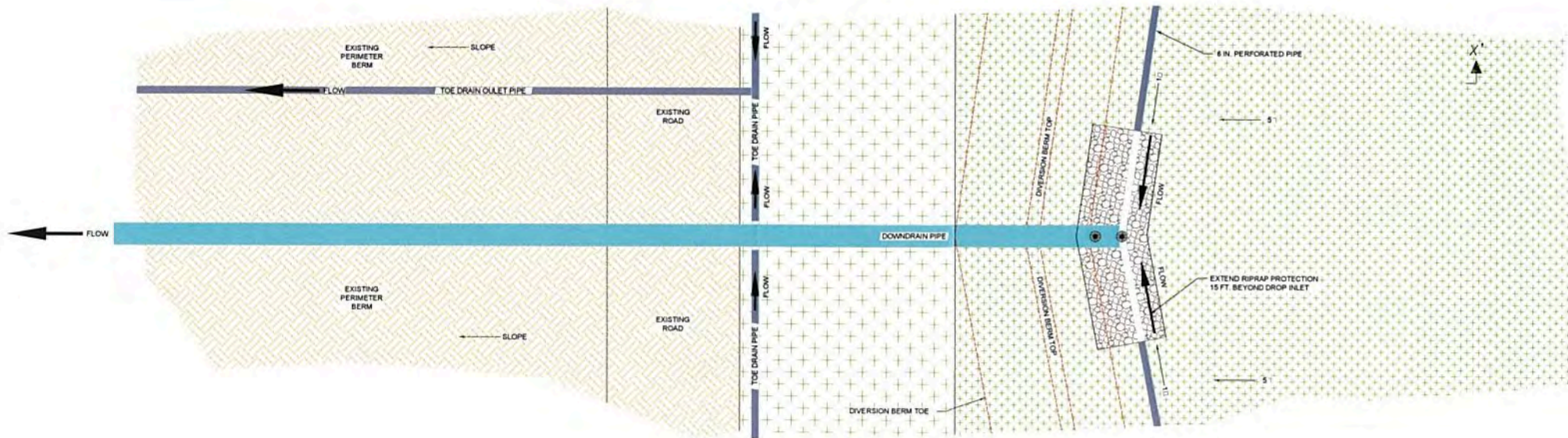


6 TYPICAL CROSS SECTION OF FINAL COVER
BETWEEN PONDS B AND A
NOT TO SCALE

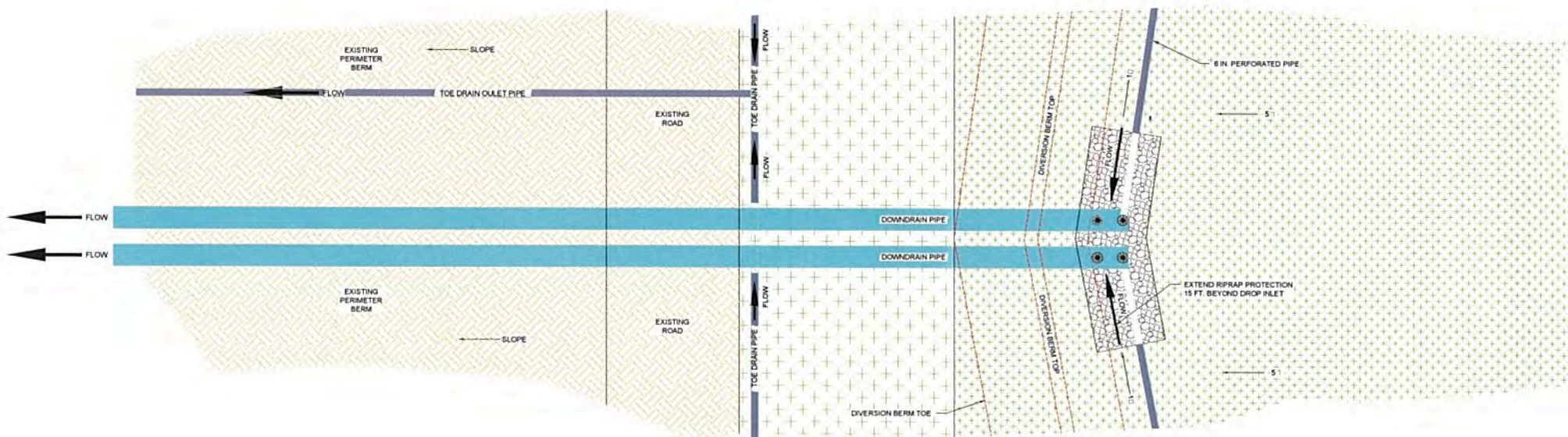
7 TYPICAL CROSS SECTION OF FINAL COVER
BETWEEN PONDS B AND C
NOT TO SCALE

- LEGEND:**
- RIPRAP
 - WASHED RIVER GRAVEL
 - CCR STRUCTURAL FILL
 - EXISTING ASH
 - EXISTING LOWER BERM
 - EXISTING UPPER BERM
 - PROTECTIVE SOIL LAYER
 - VEGETATIVE LAYER
 - EXISTING SOIL

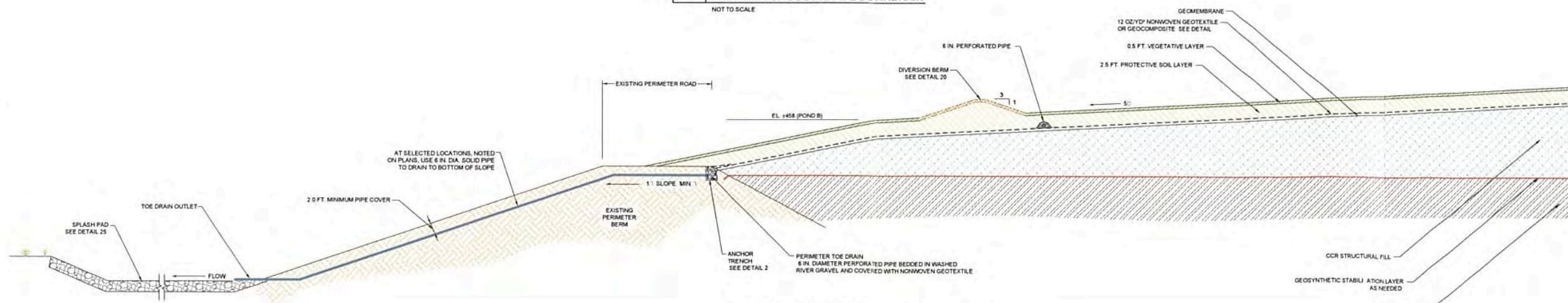
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Drawing File: SEE LOWER LEFT	Date: 5/17
Issue: AS SHOWN	App. By: [Signature]
Company Name: ATC GROUP SERVICES LLC 7888 CENTERPOINT DR. SUITE 100 INDIANAPOLIS, IN 46256 PHONE: +1 317 648 4680 WWW.ATCGROUPSERVICES.COM	
ISSUED FOR BID MAY 5, 2017	
TYPICAL DETAILS FINAL CLOSURE OF ASH POND B PETERSBURG GENERATING STATION	
Drawing Title: Sheet:	
11	



8 PLAN VIEW OF SINGLE PIPE DOWN DRAIN
NOT TO SCALE



9 PLAN VIEW OF DOUBLE PIPE DOWN DRAIN
NOT TO SCALE

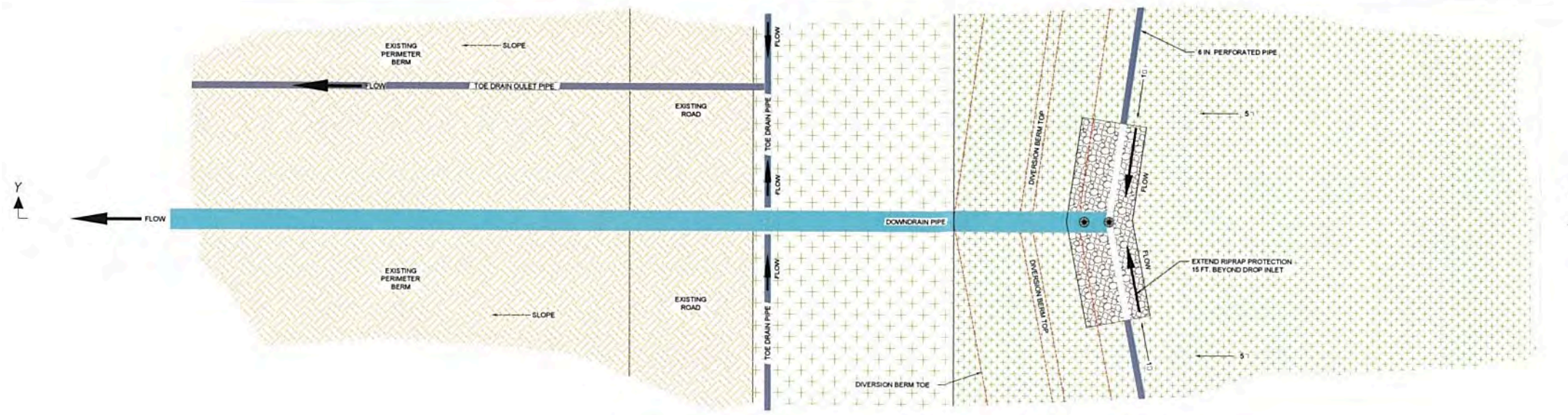


10 CROSS SECTION X-X'
CROSS SECTION OF TOE DRAIN OUTLET PIPE
NOT TO SCALE

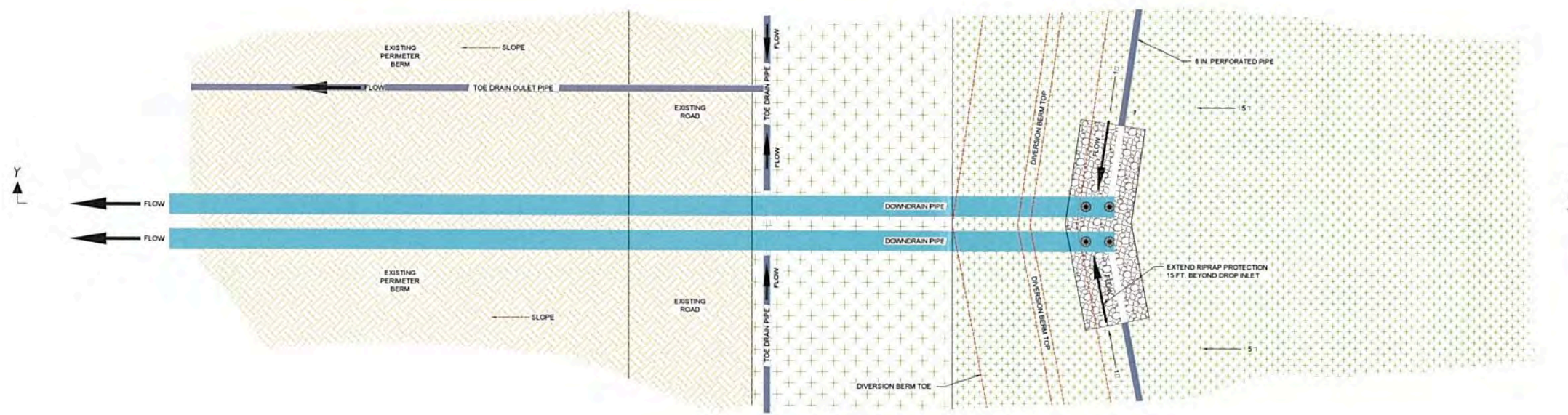
LEGEND:

	REPRAP
	WASHED RIVER GRAVEL
	OCR STRUCTURAL FILL
	EXISTING ASH
	EXISTING LOWER BERM
	EXISTING UPPER BERM
	PROTECTIVE SOIL LAYER
	VEGETATIVE LAYER

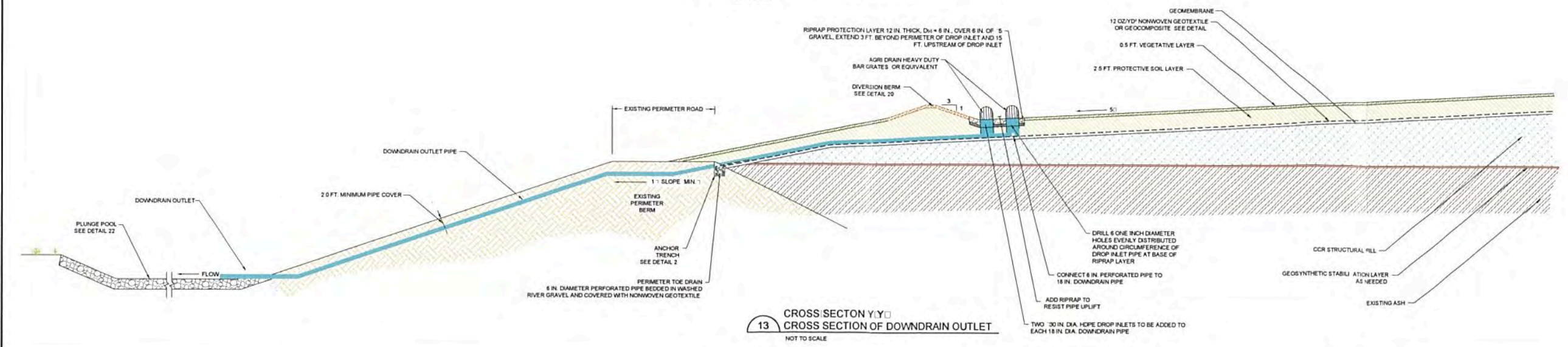
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Company Name: ATC GROUP SERVICES LLC 7888 CENTERPOINT DR. SUITE 100 INDIANAPOLIS, IN 46256 PHONE: +1 317 849 4980 FAX: +1 317 849 4278 WWW.ATCGROUPSERVICES.COM		Project Name: IPL PETERSBURG GENERATING STATION 6925 NORTH STATE ROAD 57 PETERSBURG, INDIANA ISSUED FOR BID MAY 5, 2017
		Drawing Title: TYPICAL DETAILS FINAL CLOSURE OF ASH POND B PETERSBURG GENERATING STATION
Sheet:		12



11 PLAN VIEW OF SINGLE PIPE DOWN DRAIN
NOT TO SCALE



12 PLAN VIEW OF DOUBLE PIPE DOWN DRAIN
NOT TO SCALE



13 CROSS SECTION Y-Y
CROSS SECTION OF DOWN DRAIN OUTLET
NOT TO SCALE

LEGEND:

	RIPRAP
	WASHED RIVER GRAVEL
	CCR STRUCTURAL FILL
	EXISTING ASH
	EXISTING LOWER BERM
	EXISTING UPPER BERM
	PROTECTIVE SOIL LAYER
	VEGETATIVE LAYER

Project Number: 1701/00104 Drawing No: SEE LOWER LEFT Date: 5/17 Scale: AS SHOWN		Revision: 5/16/17 - NO. 1 - TEXT CHANGED ON LEGEND
Company Name: IPL PETERSBURG GENERATING STATION 6925 NORTH STATE ROAD 57 PETERSBURG, INDIANA		ISSUED FOR BID MAY 5, 2017
ATC GROUP SERVICES LLC 7988 CENTERPOINT DR. SUITE 100 INDIANAPOLIS, IN 46256 PHONE: +1 317 849 4980 FAX: +1 317 849 4278 WWW.ATCGROUPSERVICES.COM		
Drawing Title: TYPICAL DETAILS FINAL CLOSURE OF ASH POND B PETERSBURG GENERATING STATION		Sheet: 13

DESCRIPTION DEWATERING BASIN

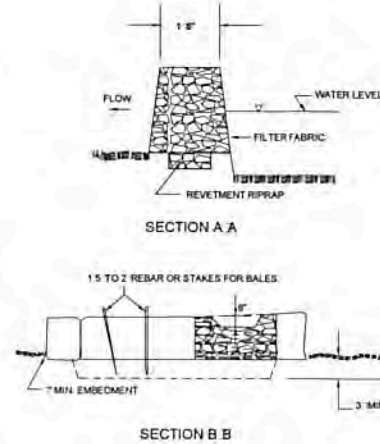
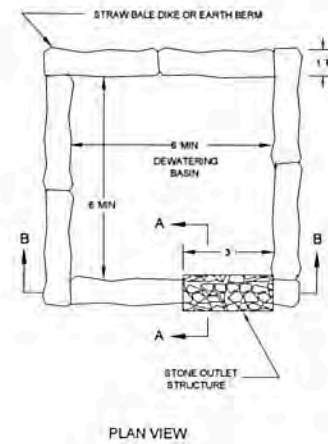
THE WORK SHALL CONSIST OF THE CONSTRUCTION OF A DEWATERING BASIN FOR THE PURPOSE OF RECEIVING SEDIMENT LADEN WATER PUMPED FROM THE BORROW AREA TO ALLOW FILTRATION BEFORE THE WATER RE-ENTERS THE WATERWAY. PUMPING INTO THESE BASINS SHALL CEASE WHEN THE EFFLUENT FROM THE BASIN BECOMES SEDIMENT LADEN. SURFACE FLOWS SHALL BE DIVERTED AROUND THIS DEVICE.

MATERIAL SPECIFICATIONS DEWATERING BASIN:

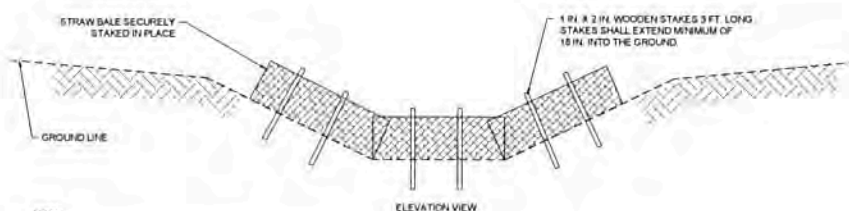
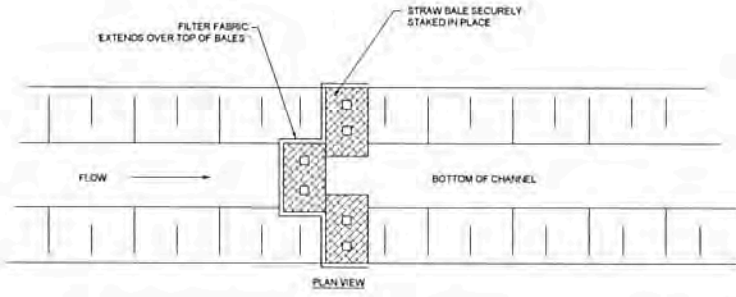
1. RIPRAP: RIPRAP SHALL CONSIST OF CLASS 1 RIPRAP CHANNEL PROTECTION.
2. FILTER GEOTEXTILE.

NOTES DEWATERING BASIN:

1. THE CONTRACTOR SHALL INSTALL ALL SEDIMENT AND EROSION CONTROL DEVICES PRIOR TO THE START OF ANY DEWATERING OPERATIONS OUTSIDE THE LIMITS OF THE ASHPOND.
2. THE OUTFALL FROM THE BASIN SHALL HAVE A STABILIZED CONVEYANCE TO RECEIVING WATERS.
3. EXCAVATED MATERIALS SHALL BE STORED SUCH THAT SEDIMENT IS PREVENTED FROM ENTERING THE WATERWAY.
4. EXCAVATED SUBSOIL AND TOPSOIL SHALL BE KEPT SEPARATE AND REPLACED IN THEIR NATURAL ORDER.
5. ANY DEWATERING OF THE CONSTRUCTION AREA SHALL WHEN PRACTICAL, BE FILTERED THROUGH A DEWATERING BASIN PRIOR TO ENTERING THE WATERWAY.
6. THE DEWATERING BASIN SHALL BE EXCAVATED TO A MINIMUM DEPTH OF 3 FEET AND HAVE A LEVEL BOTTOM.
7. ONCE THE DEWATERING BASIN BECOMES FILLED TO 1/2 OF THE EXCAVATED DEPTH, ACCUMULATED SEDIMENT SHALL BE REMOVED AND DISPOSED OF IN AN APPROVED DISPOSAL AREA.
8. THE LOCATION'S OF THE BASIN'S SHALL BE DETERMINED IN THE FIELD BUT SHALL NOT BURCHARGE POTENTIALLY UNSTABLE SLOPES.

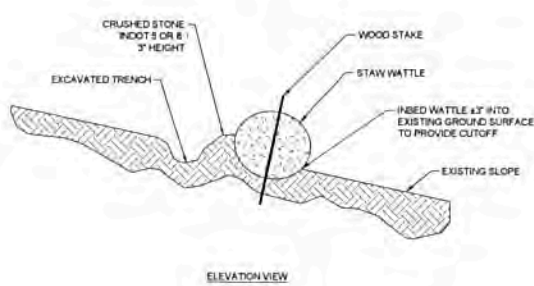


11 DEWATERING BASIN
NOT TO SCALE

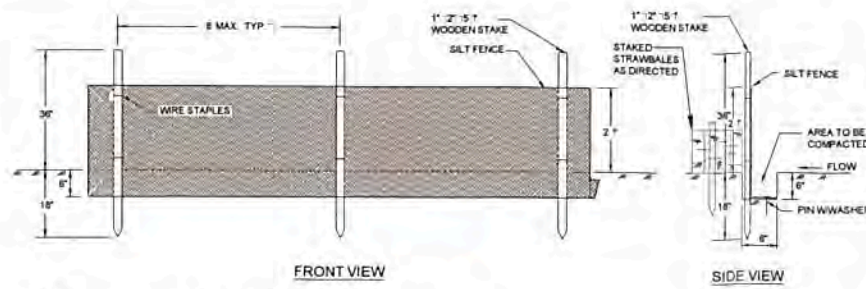


NOTE:
STRAW BALE SILT CHECK SHALL BE PLACED AS DIRECTED BY DUKE

15 STRAW BALE SILT CHECK
NOT TO SCALE

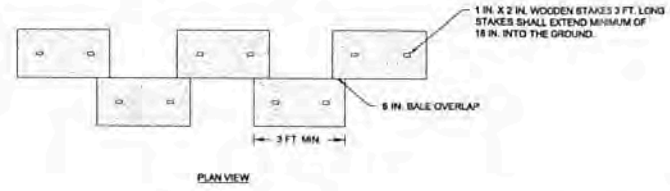


16 CONTOUR STRAW WATTLES
NOT TO SCALE

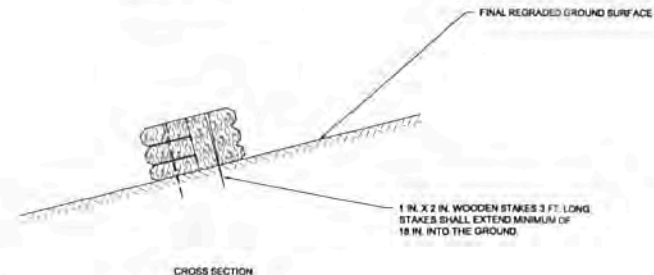


NOTE:
1. THE SILT FENCE SHALL BE REINFORCED WITH STAKED STRAWBALES AT POINTS OF HEAVY SILT BUILDUP, HIGH WATER VELOCITIES, AND OTHER CONDITIONS DEEMED NECESSARY BY DUKE. REPRESENTATIVE.

17 TEMPORARY EROSION CONTROL SILT FENCE
NOT TO SCALE

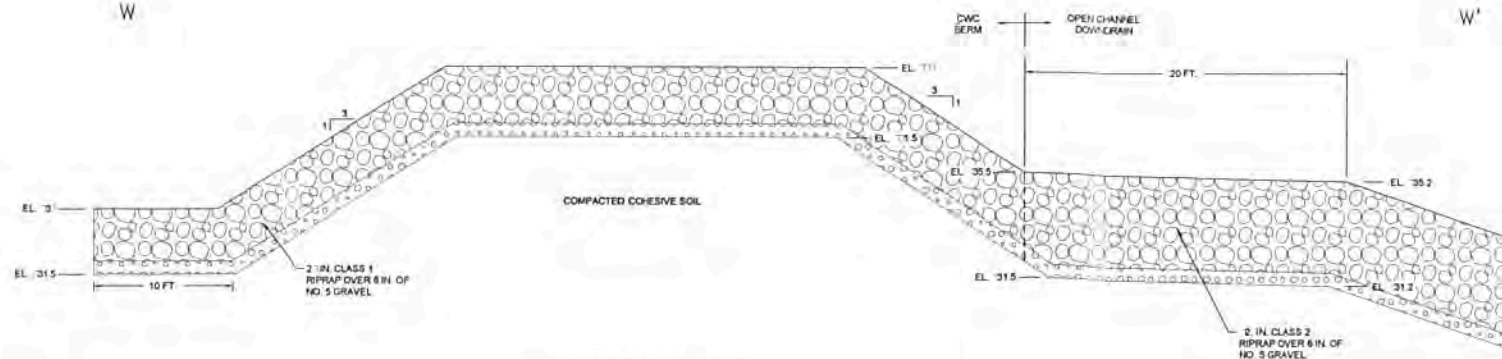


EROSION CONTROL BALES
(2.5 LIN. FT. / EA. BALE)

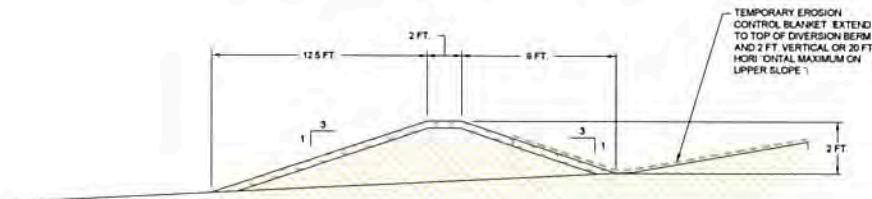


NOTE:
STRAW BALE SILT FENCE SHALL BE PLACED AS DIRECTED BY DUKE

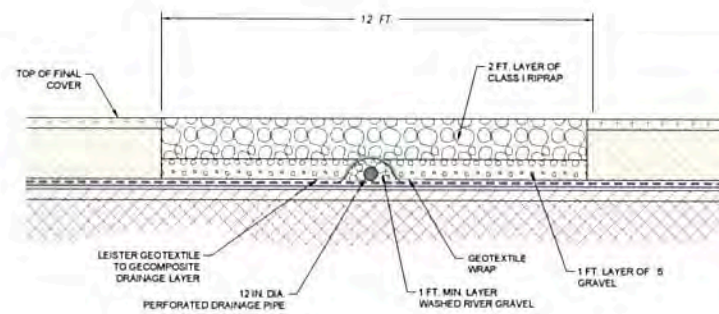
18 TYPICAL DETAIL STRAW BALE SILT FENCE
NOT TO SCALE



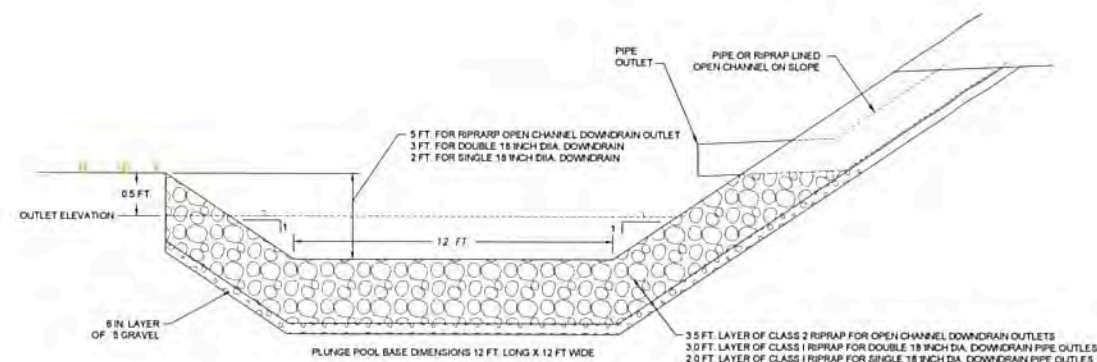
19 TYPICAL DETAIL CONTACT WATER CONTAINMENT BERM
ACROSS B/C VALLEY BOTTOM TRANSVERSE CENTERLINE
NOT TO SCALE



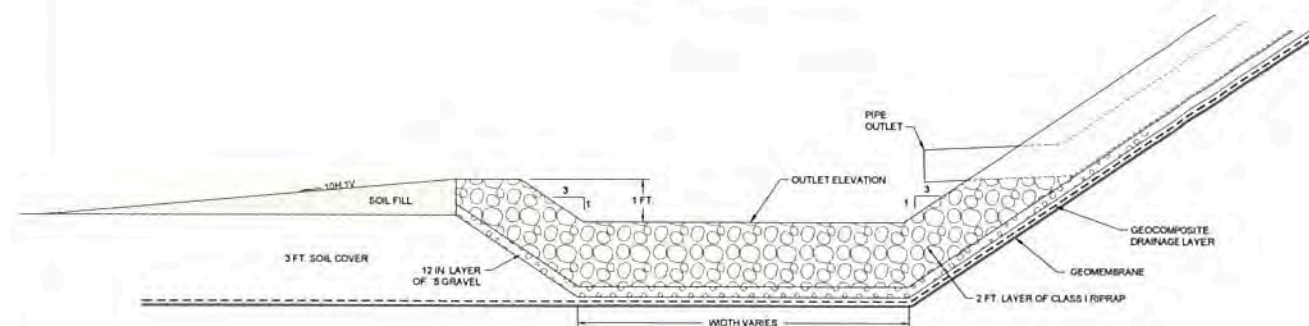
20 DIVERSION BERMS
NOT TO SCALE



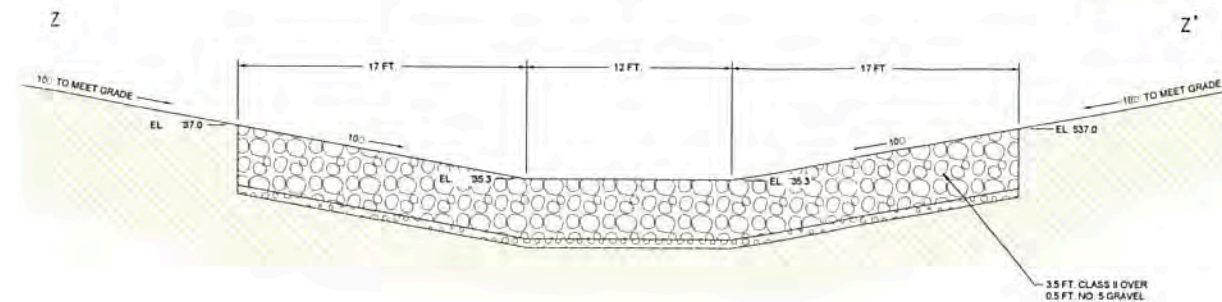
21 TYPICAL DETAIL OF RIPRAP LINED B/C VALLEY BOTTOM
NOT TO SCALE



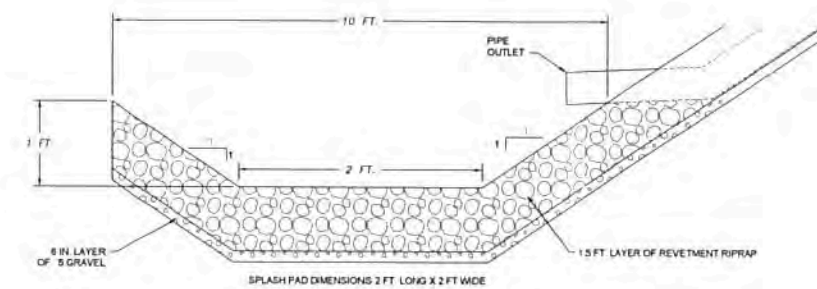
22 PLUNGE POOL IN FLOODPLAIN
NOT TO SCALE



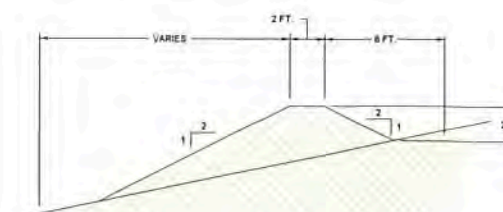
23 PLUNGE POOL IN VALLEY B/C
NOT TO SCALE



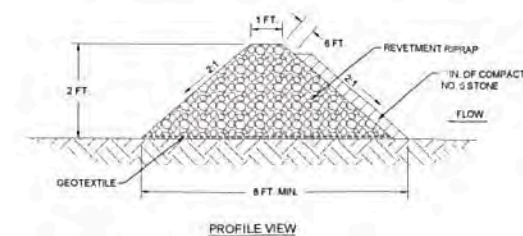
24 CROSS SECTION RIPRAP OPEN CHANNEL DOWNDRAIN
NOT TO SCALE



25 SPLASH PAD IN FLOODPLAIN
NOT TO SCALE



26 TEMPORARY CONTACT WATER CONTAINMENT BERM TYPICAL DETAIL
NOT TO SCALE



27 ROCK CHECK DAM
NOT TO SCALE

EXISTING	PROPOSED
	RIPRAP
	COP STRUCTURAL FILL
	FSS STRUCTURAL FILL
	EXISTING ASH
	EXISTING PERIMETER BERM
	PROTECTIVE SOIL LAYERS
	0.5 FT TOPSOIL

Project Name IPL PETERSBURG GENERATING STATION 6925 NORTH STATE ROAD 57 PETERSBURG, INDIANA	
Project Number 1705/00104	Sheet SEE LOWER LEFT
Drawn By 5/17	Check By AS SHOWN
App'd By	Rev
Company Name ATC GROUP SERVICES LLC 7988 CENTERPOINT DR. INDIANAPOLIS, IN 46256 PHONE +1 317 848 4880 FAX +1 317 848 4278 WWW.ATCGROUPSERVICES.COM	
<p>TYPICAL DETAILS FINAL CLOSURE OF ASH POND B PETERSBURG GENERATING STATION</p>	
Sheet	15

APPENDIX B-2

Ash Pond B Final Cover Construction Technical Specification, May 8, 2017

**INDIANAPOLIS POWER & LIGHT
PETERSBURG GENERATING STATION
ASH POND B
FINAL COVER CONSTRUCTION**

MAY 8, 2017

Prepared For:

Petersburg Generating Station
6925 N State Road 57
PO Box 436
Petersburg, IN 47567-0436

INDIANAPOLIS POWER & LIGHT COMPANY

**Final Cover Construction
Ash Pond B
Petersburg Generating Station
Petersburg, Indiana**

SECTION III - TECHNICAL SPECIFICATIONS

Contents of Technical Specifications

DIVISION 1 - GENERAL REQUIREMENTS

DIVISION 2 – CIVIL/STRUCTURAL

SUBSECTION 02200	SITE PREPARATION
SUBSECTION 02300	EARTHWORK
SUBSECTION 02712	NONWOVEN GEOTEXTILES
SUBSECTION 02713	GEOCOMPOSITE DRAINAGE LAYER
SUBSECTION 02778	LLDPE GEOMEMBRANE
SUBSECTION 02920	SEEDING
SUBSECTION 15150	DRAINAGE PIPES

Attachments

Quality Assurance Manual (QAM)

Project Drawings Issued for Bid 05/xx/2017

<u>Drawing Number</u>	<u>Title</u>
001	Title Sheet and Index
002	Legends, Abbreviations and Notes
003	Existing Conditions – 2016 Aerial Photography
004	Existing Conditions – Topographic Mapping
005	Final Cover Subgrade Plan
006	Final Cover Grading Plan
007	Location of Surface Water Control Structures
008 - 009	Cross Sections
010 – 015	Typical Details

DIVISION 1 - GENERAL REQUIREMENTS

1. **OWNER OF WORK**

Indianapolis Power & Light Company (IPL)
One Monument Circle
Indianapolis, IN 46204-2901

2. **LOCATION**

- 2.1 Indianapolis Power & Light Company
Petersburg Generating Station
6925 N State Road 57
PO Box 436
Petersburg, Indiana 47567-0436

- 2.2 Directions to Petersburg Generating Station – SR 57 to plant entrance road approximately 2 miles north of Petersburg IN. The Station is located on the west side of SR 57. After “Checking In” at Security Gate proceed to the appropriate Contractor Parking Lot. Personnel access is through the Contractor Turnstiles

and Work Vehicles will access through the Contractor Drive-in Gate. Access will be allowed according to the Petersburg Site Rules and Regulations.

3. CODES AND STANDARDS

- 3.1 The following references are applicable to the design, manufacture, erection, and testing of the systems and shall form a part of this Specification to the extent specified herein. All references to Codes, Specifications, and Standards are to the latest issue to each, together with the latest appendices, additions, and/or amendments hereto, as to the date of the Bid Specification. References to sponsoring agencies and codes will be made in accordance with the abbreviations indicated:

ANSI - American National Standards Institute
ASCE - American Society of Civil Engineers
ASTM - American Society of Testing and Materials
COE - (United States Army) Corp of Engineers
EPA - (United States) Environmental Protection Agency
GSI - Geosynthetic Institute
IDEM - Indiana Department of Environmental Management
IDNR - Indiana Department of Natural Resources
INDOT - Indiana Department of Transportation
OHSA/IOSH - Occupational Safety and Health Act/Indiana OSHA
SPCC - Spill Prevention, Control, and Countermeasures
FRP - Facility Response Plan
SWPPP- Stormwater Pollution Prevention Plan
USACE - United States Army Corp of Engineers

- 3.2 All design requirements and information continued herein represent IPL's minimum requirements and shall be reviewed by the Contractor for compliance with all local, state and federal requirements.

4. SCOPE OF WORK

- 4.1 Unless otherwise noted, Contractor shall furnish material, labor, supervision, tools, equipment, supplies, facilities and services required to complete the construction of the final cover system for Ash Pond B and a portion of Ash Pond C. In general, the following activities are included in the scope of work.

- Construction and maintenance of stormwater controls to prevent the release of water that has been in contact with the Ash Pond B or Ash Pond C CCR materials. Prior to April 17, 2018, contact water shall only be discharged into Ash Ponds A, A' or C, unless otherwise approved in advance by IPL. Any contact water generated within the Ash Pond B or Ash Pond C work area following April 17, 2018 shall be contained within Ash Pond B or Ash Pond C, pumped into storage tanks and transported to the onsite Wastewater Treatment Facility, at no additional cost to IPL.
- Regrading of existing CCR materials within the project limits to form the subgrade for the final cover system.
- Installation of both smooth and textured 40 mil LLDPE geomembrane and a geotextile/geocomposite drainage layer within the limits noted on the Drawings.
- Excavation and backfilling of all anchor trenches, including toe drains, in support of the installation of the geosynthetic materials.
- Installation of perforated drainage pipes.
- Purchase, excavate, load, transport and place borrow soils obtained from an off-site source to form the soil cover (i.e., the 2.5 ft protective layer and 0.5 ft vegetative layer) over the geosynthetic materials.
- Construct storm water diversion berms from borrow soils obtained from an off-site source and install drop inlets, drainage pipes and riprap protection as noted on the Drawings.
- Construct riprap lined outlet channels as noted on the Drawings.

- Vegetation of all areas disturbed during construction activities.
- 4.2 Contractor shall work in close coordination with IPL's Representative. The Representative is authorized to sign off and verify that Work has been performed in accordance with IPL's design documents and Drawings. Contractor shall coordinate all required field and laboratory testing with IPL's Testing Consultant Firm. Contractor shall also coordinate its activities with those being performed by ATC Group Services LLC (ATC) and Petersburg Generating Station Operations.
- 4.3 Contractor shall coordinate all Work, including its subcontractors, to ensure maximum efficiency and safety.
- 4.4 Contractor shall perform all interrelated collateral and incidental Work required, but not specifically covered, to produce the desired intention of this Contract.
- 4.5 The Contractor shall be responsible for their layout and construction staking required on this project including, but not limited to, laying out and staking of the earthwork areas as indicated in the Drawings and any staking requested by IPL's Representative for maintaining the integrity of the Work. All construction staking shall be performed under the direction of a Professional Land Surveyor (PLS) registered in the State of Indiana. There shall be no separate payment for the Contractor's staking work. The cost shall be incidental to and included in the Contractor's lump sum bid. Information regarding existing benchmarks for horizontal and vertical control located within the limits of the Petersburg Generating Station Facility will be provided prior to the start of the project.
- GPS equipment is required for layout and construction controls. All earthwork operations shall be performed with GPS machine guidance and control technology, unless otherwise approved by IPL. IPL will provide AutoCAD files of the elevation of the top of the final cover grades for the Contractor's use.
- 4.6 The Contractor shall provide an office trailer for use during this project. Contractor shall also provide all storage facilities required for his tools and equipment. The trailer and storage facilities shall be installed at a location approved in advance by IPL. Contractor shall maintain trailer and storage facilities during the project.
- 4.7 All temporary power requirements and communication (i.e., phones, radios, etc) requirements will be furnished by the Contractor. Electrical service will be supplied by IPL for the existing office trailer. Any additional temporary power requirements and all communication requirements shall be furnished by the Contractor.
- 4.8 The Contractor is responsible for transportation of his work force, including all subcontractors, from the Contractor's parking lot to the work area after passing thru the contractor employee turnstiles. An alternative would be to provide a daily shift log, with a list of all onsite personnel, to IPL site security and to the IPL representative.
- 4.9 Fueling areas, containment berms, etc., shall meet all Federal, State and Local requirements. Any temporary fuel storage tanks shall be double walled.
- 4.10 The Contractor is advised that there are major electric transmission lines in the general vicinity of Ash Pond B. The Contractor shall take all precautions necessary to protect these lines and to address the safety concerns related to clearance around these lines. Unless otherwise approved in advance by IPL, a minimum clearance of 20 ft shall be maintained from the Contractor's equipment to the transmission lines at all times.
- 4.11 The Contractor is advised that Ash Ponds A and A' are currently active and that initial fill placement has started in Ash Pond C. The Contractor shall not disrupt operations in these adjoining area unless approved in advance, in writing, by IPL.

- 4.12 The Contractor is advised that there is an active railroad located immediately east of the ash pond system. All work to be performed in the vicinity of the railroad alignment shall be performed in a manner to prevent any disruption to the use of the rail system and to meet all safety requirements.
- 4.13 It is the Contractor's responsibility to locate all utilities, make appropriate arrangements to avoid/protect the utilities, maintain the utility service throughout the construction period, and make final restoration of the utilities as needed. The Contractor shall maintain the markings (i.e., flagging, paint, etc.) along the utility lines throughout the duration of this project. It is emphasized that a concerted effort must be made to prevent any disruption of service; in the event such disruption occurs, the Contractor must immediately correct same, at no cost to IPL.
- 4.14 Contractor shall supply daily shift logs, project monitoring tools, inspection reports, and other project documentation as set forth in these Specifications. This documentation shall include the submittal of written progress reports submitted to IPL's representative each day that work is performed. Submit daily shift log no later than 9AM each day work is being performed.
- 4.15 The Contractor's on-site project superintendent shall be available for weekly progress meetings at no additional cost to IPL. The Contractor's project manager shall be available for monthly progress meetings at no additional cost to IPL.
- 4.16 Unless otherwise directed by IPL's Representative, the Contractor shall properly collect and store all trash materials, and transport and dispose of these materials at Advance Disposal's Blackfoot Landfill. Oil spills shall be contained and disposed of, by the Contractor, at an approved disposal facility. Contractor shall immediately notify IPL of all spills. Equipment maintenance areas shall be maintained in an acceptable condition and in accordance with IPL requirements.
- 4.17 It shall be the Contractor's responsibility to maintain drainage within the project limits. This includes the control of surface water runoff that has been in contact with the CCR materials and with surface water runoff from previously vegetated areas. With the prior approval of IPL's Representative, following case-by-case jurisdictional analysis, the Contractor may use temporary pipes or culverts in the localized non-jurisdictional ditches or drainages to maintain flow and to prevent blockage. The placement of pipes or culverts in any likely jurisdictional ditches, drainages, or streams, within the project limits or access roads shall require further permit applicability review and approval by IPL's Representative. The placement of pipes or culverts in likely jurisdictional waters may require a modification to the Indiana Department of Natural Resources Construction in a Floodway Permit or a Section 401 Water Quality Certification and Section 404 Regional General or Individual Permit to the IDEM and USACE agencies. Should any existing culverts become inoperable or damaged because of Work required under this Contract, the Contractor shall immediately replace it or restore it in a manner approved by IPL with in-kind dimensions and materials at no additional cost to IPL. The control of surface water runoff and the maintenance of flow through drainage features (both existing and installed for this project) shall be considered incidental to the overall accomplishment of the project. Flow capacities of all existing ditches and culverts shall be restored at the completion of this project unless otherwise approved by IPL.
- 4.18 The Contractor is advised that there will be multiple major construction projects being performed at the Petersburg Generating Station at the same time that this project will be performed. It is anticipated that the combined traffic associated with normal operations and these construction projects will result in traffic congestion in some areas. The Contractor is responsible for providing all necessary traffic control associated with this project. All such efforts shall be coordinated in advance with IPL.
- 4.19 In general, the Work consists of placing and compacting CCR materials to complete the preparation of the final cover subgrade for Ash Pond B and a portion of Ash Pond C. CCR materials will be transported and stockpiled within the limits of Ash Ponds B and C by others. CCR Structural Fill has already been placed by others over a significant portion of the Ash Pond B area. The majority of the area which requires fill placement is around the perimeter of the pond. The Work also includes final grading and maintenance of

the entire surface of the final cover area, installing the geosynthetic materials for the final cover system, constructing the protective and vegetative layers, installing diversion berms, drainage piping and outlet channels, and vegetating areas disturbed during construction. The Work overview for each of these areas is outlined below.

4.20 Work Overview for Base Bid– This Section lists the major work to be performed by the Contractor:

4.20.1 General Scope of Work Applicable to all Work Areas

- a. Provide manufacturer's data, specification sheets and samples of all geosynthetic materials proposed for use on this project as required by IPL or the CQA Consultant for use in performing all pre-construction testing required by these specifications and IDEM. The Contractor is advised that the material specifications, including interface friction requirements, must be met. All geosynthetic materials must be approved by IPL before materials are shipped to the job site. IPL is not responsible for any geosynthetic materials purchased by the Contractor that do not meet the project specifications.
- b. Provide Project Staking for Control of Cut/Fills. Survey Control Monuments shall be established by IPL after agreement with Contractor on its control requirements.
- c. The collection and discharge of water that has been in contact with the CCR materials in Ash Ponds B and C on a full-time basis (including nights, weekends and holidays) throughout the duration of the project. The release or discharge of water that has been in contact with CCR materials to any location other than Ash Ponds A, A' or C is strictly prohibited unless approved in writing in advance by IPL.
- d. All dewatering required to facilitate the regrading of CCR materials within Ash Ponds Band C and adjoining areas, the placement of structural fill, the installation of the geosynthetics, the placement of the protective and vegetative layers, the construction of the diversion berms, vegetating areas disturbed during construction, and the installation of drop inlets, drain pipes and outlet channels, on an as-needed basis throughout the duration of the project.
- e. Installation, maintenance and removal of all erosion control measures installed per these specifications and in compliance with the approved IDNR and IDEM permits or at the request of IPL.
- f. Provide all dust control measures required to meet all Site, Local, State and Federal Requirements. The Contractor is advised that he is responsible for controlling dust within the areas requiring regrading of CCR materials, the placement of structural fill, the placement area for the final cover soils and any haul routes utilized by the Contractor for the duration of the project. No additional payment will be made for Contractor to control dust during weekends, holidays and/or any other delays in the work schedule.
- g. Provide all erosion control measures required to meet all Site, Local, State and Federal Requirements. The Contractor is advised that he is responsible for controlling erosion within the Ash Pond B and C work limits and any haul routes utilized by the Contractor. Contractor is also responsible for maintenance and repair of all areas during this project.

The Contractor shall purchase, excavate, load, transport and place all of the soils needed to complete this project (i.e., protective layer, vegetative layer, and erosion control berms). All soils shall be obtained from an off-site borrow source(s) selected by the Contractor. Prior to final selection of the proposed borrow source, the Contractor shall work with IPL's Representatives to complete a subsurface investigation of the proposed borrow material. Contractor shall complete test borings and/or test pits in the borrow area as directed by IPL's Representative. IPL's Representative shall observe the field investigation and collect soil samples for laboratory testing. Final approval for the borrow source is subject to laboratory verification that the proposed borrow materials meet the project specifications.

- h. Other incidental Work necessary to complete the Project as required by the Specifications and Project Drawings.

4.20.2 General Scope of Work for filling of Ash Pond B and a portion of Ash Pond C to form Final Cover Subgrade.

- a. Purchase, excavate, load, transport and place soil to form the temporary contact water containment berms.
- b. Placement and compaction of CCR Materials transported to Ash Ponds B and C by others to form the final cover subgrade. The materials shall be obtained from stockpiles of CCR materials placed by others in proximity to the grading operations.
- c. Final grading of both existing CCR materials and recently placed CCR Materials to form the subgrade for the final cover system. This includes the maintenance of the subgrade prior to the installation of the geosynthetic materials.
- d. Other incidental Work necessary to complete the Project as required by the Specifications and Project Drawings.

4.20.3 General Scope of Work for Installation of Geosynthetics required for the Construction of the Final Cover in Ash Pond B and a portion of Ash Pond C.

- a. Excavation and backfilling of anchor trenches and toe drains associated with the geosynthetics utilized in the final cover system.
- b. Installation of 40 mil LLDPE geomembrane liner over the designated portions of the final cover area.
- c. Installation of the geotextile/geocomposite drainage layer material over the 40 mil LLDPE geomembrane liner.
- d. Installation of the nonwoven geotextile associated with the drainage pipes and outlet channels.
- e. Installation of toe drain pipes and perforated drainage pipes.
- f. Other incidental Work necessary to complete the Project as required by the Specifications and Project Drawings.

4.20.4 General Scope of Work for Construction of Protective Layer and Vegetative Layer for Ash Pond B Final Cover.

- a. Purchase, excavate, load, transport and place 30 inches of protective cover soils over areas that receive the geosynthetic cover. The protective layer shall consist of 30 inches of cohesive soil. The soils shall be obtained from an off-site source approved in advance by IPL.
- b. Purchase, excavate, load, transport and place 6 inches of vegetative cover soils obtained from an off-site source approved in advance by IPL.
- c. Excavate and backfill down drain pipe trenches.
- d. Construction of storm water diversion berms, installation of drainage pipes and drop inlet structures, and construction of outlet channels/plunge pools.
- e. Vegetate the final cover soils and all areas disturbed during construction of the final cover system.

- f. Other incidental Work necessary to complete the Project as required by the Specifications and Project Drawings.

4.21 The Contractor shall perform extra work for which there is no quantity or price in the Bid Schedule only when directed to do so in writing by IPL. Such work will be paid for at a lump sum price or at unit prices stipulated in a Change Order to the Contract Documents.

4.22 It is noted that portions of the project are located in the floodplain of the White River. The areas where the final cover will be placed over Ash Pond B and portions of Ash Pond C are protected against the 100-Year Flood Elevation, however, other project areas (i.e., the toe of slope of the Ash Pond B, down drain pipe outlets and outlet channels) may be susceptible to flooding. It is the Contractor's responsibility to safely store all materials and equipment. Additional payment will not be made by IPL for equipment and/or materials that are damaged by flooding.

5. SCHEDULE OF WORK

5.1 The Contractor is advised that the discharge of water that has been in contact with the CCR materials in Ash Pond B must cease prior to April 1, 2018. Therefore, IPL prefers to complete as much of the project as possible prior to that deadline. However, at a minimum, it will be necessary to complete the installation of the all of the geomembrane prior to this deadline.

The following is the current schedule of construction, which is subject to modification as noted above.

a. Mobilization	NLT	06/15/17
b. Complete the installation of the geomembrane	NLT	10/01/17
c. Complete the installation of the soil cover	NLT	11/01/17
d. Complete the installation of diversion berms, drop inlets and down drain pipes.	NLT	12/01/17
e. Complete the vegetation of all areas disturbed during construction	NLT	04/01/18
g. Completion of Remaining Work	NLT	05/01/18
h. Final Demobilization	NLT	06/01/18

NLT = No Later Than

Note: IPL reserves the right to revise both the start and the completion dates of each Phase of Construction.

6. WORK BY OTHERS

6.1 IPL has contracted ATC Group Services LLC (ATC) to perform Construction Quality Assurance Services for this project. Contractor will coordinate directly with ATC for all required testing and/or additional testing as directed by IPL.

6.2 Surveying as required to provide third party verification of the final limits and thickness of the final cover vegetative layer and the horizontal and vertical locations of drop inlets and pipes. This does not include surveying required to support the construction activities.

7. IPL PROVIDED SERVICES

- 7.1 Technical and Commercial Contract contacts.
- 7.2 Safety orientation on IPL Rules and Regulations-Petersburg Station will be provided.
- 7.3 Water Source(s) for Contractor Non-Potable Water and Dust Control.

8. ENVIRONMENTAL CONDITIONS

- 8.1 Dust Control – Contractor shall implement a Dust Control Plan, in accordance with INDOT 107.08(b) and shall meet all Site, Local, State and Federal requirements for controlling fugitive dust. A water truck(s) will be required onsite at all times to assist in dust control as a part of this plan. The Contractor's Dust Control Plan shall be contained within the Contractor's Work Plan.
- 8.2 Erosion Control - Contractor shall abide by the current Rule 5 permit (327 IAC 15-5) (obtained by IPL) for the Construction/Storm Water Pollution Prevention Plan (SWPPP) approved by the Petersburg County Soil & Water Conservation District for this project and the facility's existing SWPPP (as determined applicable by IPL and Contractor). Contractor is solely responsible for posting, and complying with the SWPPP. Further, the Contractor shall meet all Local, State (ref INDOT Section 203.08, c) and Federal requirements for implementing and controlling erosion. The Contractor's Erosion Control Plan shall be contained within Contractor's Work Plan.
- 8.3 Cleanup – Areas where equipment is parked shall be kept in a clean and orderly manner. Any oil spills, etc. shall be properly handled and disposed of per OSHA and the plant's SPCC/FRP/SWPPP Requirements. If the vendor plans to bring any chemicals/oil on-site as part of the project, IPL shall be provided a list of the chemicals, quantities and storage method prior to bringing the materials on-site. In addition, the Contractor will be responsible for either complying with the facility's SPCC/FRP plans or developing and implementing a SPCC plan specific to this project work that has been reviewed and approved by IPL prior to commencement of work. Roadways shall be kept clean of soil buildup throughout the Project period. All unused materials shall be removed and disposed of properly off-site. Contractor shall be vigilant in its efforts to keep the Work areas in a clean and safe condition. Any approved disturbed areas shall be regraded and seeded in accordance with these Specifications unless otherwise directed by IPL's Representative. The costs associated with clean-up shall be included as part of the lump sum cost of the project and in the unit prices that are provided with the bid. No separate payment will be made for clean-up. Contractor shall provide a dumpster for disposal of all Non-Hazardous waste materials.

9. SCHEDULE REQUIREMENTS

- 9.1 Pre-bid Conference – A mandatory site tour and pre-bid conference will be held for this project at the project site at the time and date noted in the bid announcement. Bidders are also encouraged to visit the site as needed prior to submitting bids to satisfy themselves as to the nature and scope of the project and to familiarize themselves with any difficulties attending to its execution. Arrangements to view the site at times other than the pre-bid conference should be made through IPL's Representative, Cory Richardson (317.261.6744).
- 9.2 Pre-construction Conference – Following the signing of the Contract Documents and prior to the actual beginning of the construction, a pre-construction conference will be held. Representatives of IPL, the Contractor (including any subcontractors) as well as other interested agencies and parties will be present to discuss the time and sequence for construction, methods and plans of operations, payment and other relevant questions. The time and location of this meeting will be established by IPL in consultation with other parties.
- 9.3 Normal Operations - The Contractor is advised that the Work outlined in these Specifications is to be performed within the hours of 7 AM to 6 PM Monday through Friday and 7AM to 4PM on Saturdays (if

required). Work shall not be performed outside these hours, or on holidays, unless otherwise directed by, or approved by IPL's Representative.

- 9.4 Preliminary Schedule - Contractor shall submit a P6 or Microsoft Project Schedule (or alternative approved by IPL) that it intends to utilize to complete the required Work. The Schedule shall include manpower, equipment proposed, shift length, number of shifts, etc., which Contractor plans to utilize during the Work. The Schedule shall meet dates identified in Article 5, Schedule of Work, in this Section.

9.5 Installation Schedule

- a) Contractor shall meet with IPL to formulate and finalize an agreed to "Installation Schedule" prior to Mobilization. This Schedule shall be of sufficient detail and supported with a Work Breakdown Structure necessary to meet the Project Schedule Milestones.
- b) Contractor shall adequately man, equip the job, and work such hours and days as may be necessary to meet the Work schedule. The Contractor shall include shift hours and manpower planned with the schedule format. It is emphasized that all geomembrane must be installed prior to April 1, 2018.
- c) IPL will incorporate the "agreed to" Schedule within its Scheduling System and provide Contractor with Weekly Update Sheets for Contractor to input latest progress information. Contractor supplied information shall be updated (weekly) and discussed in Weekly Progress Meetings consistent with the needs of IPL and Others who interface with the Contractor. If any dispute arises relative to the technical aspects of the schedule, the written resolution by IPL shall be binding on the Contractor.

10. ISSUE OF SUBMITTAL DATA

- 10.1 Any requested engineering, design, detailed construction planning and procurement shall begin immediately after contract award, and shall proceed in an expeditious and orderly manner until complete. The required Submittal Data due dates shall meet their required due dates. The Contractor shall provide Submittal Data to IPL for review.
- 10.2 All Submittal Data being transmitted for review for the first time shall be identified as such on the transmittal sheet or letter accompanying the data. Submittals will be reviewed and returned within 14 days with approvals or comments.
- 10.3 Submittal Data that are reviewed by IPL will be returned to the Contractor with a transmittal letter, and any comments or questions will be marked on the data or noted in the letter. All comments and questions must be resolved before a reissue of the data will be processed.
- 10.4 Identification of changes on all Submittal Data Drawings from the previous issue must be clearly shown on each item of data. Changes shall be circled and marked with a revision number where practical.
- 10.5 It shall be Contractor's responsibility to obtain IPL's acceptance without comment on those Drawings covering an item before that item is to be shipped. Contractor shall be liable for the cost of any field changes resulting from failure to adhere to this requirement.
- 10.6 All submittals by Contractor shall be the property of IPL. Ownership of the Drawings and data shall be transferred to IPL after Completion of the Work and after corrections have been made to incorporate as-built field changes.

11. COMPLETENESS OF INFORMATION

- 11.1 All Drawings, data, bills of material, test reports, and diskettes shall be considered a part of the shipment and must be received by IPL prior to final payment for the Work performed under this Specification.

12. QUALITY ASSURANCE

- 12.1 Contractor shall cooperate with the inspection, testing and documentation program in effect. Contractor shall rework any deficient areas found until acceptable tests are achieved.

13. SUBMITTAL REQUIREMENTS

- 13.1 Contractor shall submit the following with its Bid, complete as identified below:

- a. Section VI: Proposal Pricing and Data Sections. (Including CPE-10's)
- b. Proposal Schedule. This shall include, at a minimum, all Work Items defined in the Schedule of Work (Article 5, this Section). Contractor shall also include post award submittal data dates, anticipated early start date and any other work it deems important to the Schedule.
- c. Project Personnel and Equipment Loadings – Contractor shall identify the number of personnel type and number of Equipment, Shifts, hours per shift and days per week planned to perform the Work for the Schedule duration. The Contractor shall submit a list of his personnel and all subcontractor personnel (and their employee numbers) that will be utilized on this project at least two weeks in advance of mobilization. This information is necessary to assist Plant Security.
- d. Contractor Work Plan – Contractor shall submit a Work Plan with proposed methods for:
 1. QA/QC and Safety Programs.
 2. Dust Control Plan. The plan must identify methods that the Contractor proposes to utilize to minimize dust problems throughout the duration of the contract. Specific information must also be provided on procedures that will be utilized to respond to dust problems that develop over weekends and holidays. The Contractor shall also provide examples of projects where similar dust control measures were utilized by his work force.
 3. Erosion Control Plan. The plan must identify methods that the Contractor proposes to utilize to minimize or correct erosion control problems throughout the duration of the contract and such methods must meet the approved 15-5 control measures. Specific information must also be provided on procedures that will be utilized to respond to problems that develop over weekends and holidays. The Contractor shall also provide examples of projects where similar measures were utilized by his work force.
 4. Spill Prevention and Response Plan. –If the Contractor plans to bring any chemicals/oil on-site as part of the project, IPL shall be provided a list of the chemicals, quantities and storage method prior to bringing the materials on-site. In addition, the Contractor shall be responsible for either complying with the facility's SPCC/FRP plans or developing and implementing a SPCC plan specific to this project work that has been reviewed and approved by IPL prior to commencement of work.
 5. Detailed description on how Work will progress and be completed.
 6. Detailed description of how Contractor will meet Environmental Conditions cited in Article 8.
- e. Project Organizational Chart identifying key personnel including Project Manager, Site Superintendent, Site Safety Officer, and other key personnel responsible for Quality Assurance, Safety, Equipment, etc. Contract shall include resumes of Key project personnel.

f. What, if any, type of labor agreement Work will be performed under.

g. Certificate of Insurance.

14. SUBMITTAL DISTRIBUTION

14.1 Contractor shall address and submit all correspondence, drawings and data as follows:

a. CORRESPONDENCE: All correspondence shall be addressed and submitted to:

Cory Richardson
IPL
3700 S. Harding Street
Indianapolis, IN 46217-3333
317.261.6744

and

Erv Leidolf
Petersburg Generating Station
6925 N State Road 57
Petersburg, IN 47567-0436
812.601.7224 – Office, 812.454.2438 - Cell

b. SUBMITTAL DATA:

Address and submit original copy of transmittal letter, drawings and data, and four (4) copies each of the submittal data to:

Cory Richardson
Project Manager
IPL
3700 S. Harding Street
Indianapolis, IN 46217-3333
cory.richardson@aes.com
317.261.6744

and

David Stelzer
Senior Project Engineer
ATC Group Services LLC
7988 Centerpoint Drive, Suite 100
Indianapolis, IN 46256-3345
dave.stelzer@atcassociates.com
317.579.4071

15. TRANSPORTATION AND HANDLING

15.1 Contractor is to provide labor and equipment for the unloading and handling of IPL-Supplied and Contractor-Supplied Materials and Equipment upon delivery to the project site.

15.2 Contractor shall furnish IPL all OSHA-required Material Safety Data Sheets for all sealants, lubricants, cleaners and other chemicals in accordance with OSHA's Hazardous Communications standards that the Contractor intends to use for the Work.

15.3 Deliver all equipment and off-site materials to project site by truck. Trucks are to be limited to on-road tri-axle or quad-axle trucks.

15.4 All trucks shall obey all posted speed and regulatory signs along the haul route. CCR material hauling trucks are to be granted the right-of-way along the haul road and at all intersections. Caution should be observed when traveling on paved roads with smaller vehicular traffic.

16. MATERIALS QUALITY

16.1 All new materials incorporated in the Work shall be new and of first-class quality, free from defects and imperfections, and where shown, of the classification and grades designated. These materials shall also meet the requirements contained in these Specifications and the Quality Assurance Manual. Materials not specifically designated herein shall be subject to IPL's written approval and shall be most suitable for its intended purpose and shall, as far as practicable, at a minimum, comply with the latest Specifications of ASTM, ASCE, ANSI, GSI or approved equivalent standards.

17. PERMITS

- 17.1 The Indiana Department of Environmental Management (IDEM) is currently reviewing a request for a permit modification regarding the construction of the final cover. Work cannot begin on this project until IPL receives IDEM's approval of the plans.
- 17.2 IPL is preparing a Construction/Stormwater Pollution Prevention Plan to the Petersburg County Soil & Water Conservation District for this project and will file the associated Notice of Intent letter with the Storm Water (Rule 5) (327 IAC 15-5) to the Office of Water Quality, Indiana Department of Environmental Management.
- 17.3 IPL is preparing a Construction in a Floodway Permit to the Indiana Department of Natural Resources for this project.
- 17.4 IPL may need to prepare a Section 401 Water Quality Certification and Section 404 Regional General or Individual Permit to the IDEM and USACE agencies, respectively if it is determined that IPL will impact streams or wetlands located within the limits of disturbance for this project.

Copies of these permits/documents are available upon request.

DESIGN DRAWINGS

- 18.1 The following Drawings shall be used for estimating quantities and construction.

<u>Drawing Number</u>	<u>Title</u>
001	Title Sheet and Index
002	Legends, Abbreviations and Notes
003	Existing Conditions – 2016 Aerial Photography
004	Existing Conditions – Topographic Mapping
005	Final Cover Subgrade Plan
006	Final Cover Grading Plan
007	Location of Surface Water Control Structures
008 - 009	Cross Sections
010 – 015	Typical Details

DIVISION 2 – CIVIL/STRUCTURAL

SUBSECTION 02200 – SITE PREPARATION

PART 1 – GENERAL

1.1 WORK DESCRIPTION

A. WORK INCLUDED

1. Furnish all necessary labor and equipment in order to satisfy soil erosion and sedimentation control requirements. Provide and perform work as detailed in Erosion Control Plan as approved by Pike County and IDEM (Ref INDOT Sections 107.15 and 203.8, c and 205).
2. Furnish all necessary labor and equipment in order to satisfy dust control requirements. The Contractor shall provide and perform work as detailed in Dust Control Plan (Ref INDOT Sections 107.08(b)) and shall meet all Site, Local, State and Federal requirements for controlling fugitive dust at all times, including weekends and holidays. A water truck will be required onsite at all times to assist in dust control as a part of this plan.
3. Furnish all necessary labor, equipment and supplies to respond to spills associated with this project per OSHA and the plant's SPCC/FRP/SWPPP Requirements.
4. Furnish all necessary labor and equipment in order to satisfy clearing and grubbing requirements.
5. Furnish all necessary labor and equipment to perform dewatering as required for the duration of the project in accordance with all permit requirements.

B. RELATED WORK SPECIFIED ELSEWHERE

1. Subsection 02300: Earthwork

PART 2 – PRODUCTS

2.1 MATERIALS

A. SOIL EROSION AND SEDIMENT CONTROL

1. The materials used to construct silt fence structures shall consist of "Envirofence" manufactured by the Mirafi Division of Celanese Corporation, or an approved equal. The fabric shall be free of any treatment which might significantly alter its physical properties. During shipment and storage, the fabric shall be wrapped in a heavy-duty protective covering to protect it from direct sunlight, dirt, and other debris. The Manufacturer shall submit certified test data to cover each shipment of material.
2. The silt fence used shall be a prefabricated silt fence with fabric already attached to posts. If a loose fabric is installed, all support posts shall be spaced at 8 ft (max) centers. Posts shall be of a wood species capable of supporting the fence as intended. End posts shall be installed in a manner so as to prevent gaps between silt fence sections. The fabric shall be a pervious sheet composed of a strong, rot-proof polymeric yarn or fiber woven into a stable network which retains its relative structure during handling, placement, and long-term service. It shall have excellent resistance to deterioration from ambient temperatures, acid, and alkaline conditions, and shall be indestructible to micro-organisms and insects. The material shall be resistant to deterioration by ultra-violet light and protected until placement as recommended by the Manufacturer such that no deterioration occurs prior

to placement. During shipment and storage, the rolls of fabric shall be protected against deterioration from the sun, mud, dirt, dust and other deleterious conditions at all times until their use.

3. Silt fence placed for this contract or to replace damaged existing material at the direction of IPL's Representative, shall be installed, maintained and removed in accordance with the negotiated unit price.
4. Straw wattles shall have a minimum diameter of 12 inches, consisting of polypropylene netting and certified weed seed free straw. During shipment and storage, the wattles shall be wrapped in a heavy-duty protective covering to protect them from direct sunlight, moisture, and debris. The wattles shall be installed as directed by IPL's Representative on the slopes of the final cover, around the drop inlet structures and for temporary surface water diversion.
5. Straw bale silt checks and/or silt fences shall be installed as directed by IPL's Representative in accordance with the details provided in the Drawings.

B. CLEARING AND GRUBBING

1. All trees and brush shall be cleared from within the earthwork limits and properly disposed of at an on-site location selected by IPL located within 1 mile of the work area. Trees cannot be removed from the site between April 1 and September 30 unless otherwise approved by IPL.

C. TOPSOIL/SURFACE SOIL REMOVAL

1. The Contractor shall remove all topsoil and/or a portion of the existing cover soils from work areas (as delineated by IPL). Topsoil is defined as fertile, friable, natural surface soil removed from within the earthwork limits or obtained from off-site borrow areas. Satisfactory topsoil is reasonably free of subsoil, stones and other objects over 2 inches. Final depth for the topsoil removal is to be verified by IPL or the QA/QC personnel at the time of construction. Topsoil materials shall be stockpiled in a location approved by IPL for use in the construction of the Ash Pond B final cover.

PART 3 – EXECUTION

3.1 CONSTRUCTION ACTIVITIES

A. SOIL EROSION AND SEDIMENT CONTROL

1. Install silt fence at the locations noted on the Drawings or as directed by IPL's Representative prior to the start of any other construction activities in that area.
2. Silt fence shall be installed and maintained in accordance with the Manufacturer's requirements which generally include the following steps:
 - a. Use a trenching machine to dig a 6 to 8 inch deep trench along proposed alignment of silt fence.
 - b. Roll out Silt Fence on the uphill side of the trench. Unroll Silt Fence with fabric side down and stake side up.
 - c. Drive stakes on the downhill side of the trench to a depth of 18 inches. Drape loose end of fabric into trench.
 - d. Backfill and compact soil into trench to secure the fabric.

- e. Inspect silt fence regularly and after each heavy rain. Accumulated sediment shall be removed as necessary, but prior to reaching half the height of the silt fence, and damaged sections shall be repaired immediately at no additional cost to IPL.
 - f. At the completion of all construction activities in each Work area (including establishment of a suitable vegetative layer on all adjoining areas) and at the direction of IPL's Representative, all silt fence shall be removed and disposed of off-site by the Contractor. Areas disturbed by the removal operation shall be revegetated in accordance with these Specifications. In general, this operation will consist of regrading, refertilizing, reseeding and remulching along the alignment of the silt fence.
 3. Install straw wattles as directed by IPL's Representative on seeded slopes, around drop inlet structures and for temporary surface water diversion.
 4. Straw wattles shall be installed and maintained in accordance with the Manufacturer's requirements which generally include the following steps:
 - a. Dig a 2 to 3 inch deep trench to conform to the shape of the wattle at the location identified by IPL's representative. On slopes, the alignment of the wattle shall follow the contour, unless otherwise directed by IPL.
 - b. Place the wattle in the trench and tamp soil excavated from the trench on the uphill side of the wattle. No daylight should be seen under the installed wattle.
 - c. Drive wooden stakes into the center of the wattle to a depth of at least 24 inches (but no more than 28 inches) below the bottom of the wattle. A minimum of 2 inches and maximum of 3 inches of the stake shall project above the top of the wattle. The stakes shall be spaced at 4 ft increments (max) with stakes placed within 2 ft of each end of the wattle.
 - d. When joining two wattles, tightly abut both ends and tie the netting together with heavy twine or plastic ties. Drive the first stake of the second wattle at an angle toward the first wattle to help maintain contact.
 - e. Inspect wattles regularly and after each heavy rain. Accumulated sediment shall be removed as necessary, but prior to reaching half the height of the straw wattle, and damaged sections shall be repaired immediately at no additional cost to IPL.

B. CLEARING AND GRUBBING

1. Limits of clearing and grubbing shall be all areas within earthwork limits noted on Drawings.
2. Clear all trees, shrubs, vegetation, fencing, construction debris and trash within earthwork limits.
3. Unless partial removal is indicated, grub all items to their full depth.
4. Remove all stumps, roots over 2 inches in diameter and matted roots within the limits of clearing and grubbing.
5. Unless otherwise approved by IPL, clearing of existing forested areas shall only occur during the time between November 15 and March 31 of any given year to minimize impacts to protected bat species and prevent the need for additional permitting with State and Federal Regulatory Agencies.

C. TOPSOIL/SURFACE SOIL REMOVAL

1. Strip topsoil/surface soil as needed within the project area. Unless otherwise directed by IPL's Representative, the depth of topsoil removal shall be approximately 12 inches.
2. Stockpile topsoil/surface soil materials at locations identified by IPL's Representative for later reuse. Construct stockpiles to freely drain surface water.
3. All soil stockpiles shall be surrounded by silt fence as directed by IPL.

3.2 DISPOSAL

A. ON-SITE DISPOSAL:

1. Unless otherwise directed by IPL's Representative, all logs, stumps, roots, cuttings, debris and other materials generated as a result of the clearing and grubbing operations shall be disposed of on-site (at a location identified by IPL, within 1 mile of the work area) at no additional cost to IPL.

END OF SUBSECTION

SUBSECTION 02300 – EARTHWORK

PART 1 – GENERAL

1.1 WORK DESCRIPTION

A. WORK INCLUDED

1. Provide all material and labor necessary to perform all earthwork noted in the Drawings.
2. Work in the Section includes, but is not necessarily limited to:
 - a. Placing and compacting CCR materials to establish the subgrade of the Final Cover in Ash Pond B and a portion of Ash Pond C, as noted on the Drawings. This includes any earthwork necessary to establish temporary berms to control the discharge of surface water that has been in contact with the CCR materials (i.e., contact water).
 - b. (Text deleted, 5-8-2017)
 - c. Construction of dewatering sumps, and dewatering as needed, within the limits of the Ash Ponds B and C to facilitate placement of the CCR Structural Fill and the placement of final cover.
 - d. Construction of dewatering sumps and dewatering as needed outside the limits of Ash Ponds B and C. Dewatering activities located outside the limits of Ash Pond B or Ash Pond C shall require the use of geobags or temporary sedimentation basins at each outlet. Contractor is responsible for supplying, installing, replacing and disposal of geobags and/or temporary sedimentation basins. Geobags shall be prefabricated woven or non-woven geotextiles of sufficient capacity for dewatering flow rates. Geobags shall be replaced when accumulation of sediment has reached half of the geobag volume. Sedimentation shall be removed from the temporary basins when the basin is half full.
 - e. Finish grading including placement of the protective layer, the vegetative layer and the erosion control berms.
 - f. Installation of crushed stone and riprap associated with drainage features at locations noted on the Drawings.
3. The earthwork shall be done in accordance with the sequence presented in this Subsection unless otherwise approved by IPL's Representative.

B. RELATED WORK SPECIFIED ELSEWHERE:

1. Subsection 02200: Site Preparation
2. Subsection 02712: Nonwoven Geotextile
3. Subsection 02713: Geocomposite Drainage Layer
4. Subsection 02778: LLDPE Geomembrane
5. Subsection 15150: Drainage Pipes

PART 2 – PRODUCTS

2.1 MATERIALS

A. FILL MATERIALS:

All soils shall be obtained from off-site borrow source(s) selected by the Contractor. Prior to final selection of the proposed borrow source, the Contractor shall work with IPL's Representatives to complete a subsurface investigation of the proposed borrow material. Contractor shall complete test borings and/or test pits in the borrow area as directed by IPL's Representative. IPL's Representative shall observe the field investigation and collect soil samples for laboratory testing. Final approval for the borrow source is subject to laboratory verification that the proposed borrow materials meet the project specifications.

1. Soils utilized in the construction of the 30 inch protective soil layer of the final cover (i.e., immediately below the vegetative layer), and all of the soils used to construct the erosion control berms (except the 0.5 ft thick vegetative layer), shall be limited to soils that are classified as ML, ML-CL, CL, CH, SC or SC-SM in accordance with the Unified Soil Classification System.
2. Riprap utilized at the inlet ends of the diversion berm drop inlets shall conform to Section 616 and 904.04 of the INDOT Standard Specifications as it relates to Revetment Riprap.
3. Riprap utilized in the plunge pools for toe drain and down drain outlets, and in the riprap lined ditches shall conform to Section 616 and 904.04 of the INDOT Standard Specifications as it relates to Revetment, Class 1 and Class 2 Riprap, as noted on the Drawings.
4. Crushed limestone utilized as the gravel bedding beneath the riprap shall meet the Specifications for a No. 5 coarse aggregate and shall conform to the General Requirements of Section 904.02 of the INDOT Standard Specifications.
5. Additional aggregates may include No. 2, No. 8, No. 53, No. 73, or similar, as requested by IPL. All limestone gravel shall meet the Specifications for coarse aggregates and shall conform to the General Requirements of Section 904.02 of the INDOT Standard Specifications.
6. Erosion Control Mat utilized along the flowline of the diversion berms (as noted on the Drawings) shall consist of North American Green EroNet S75 Short-Term Photodegradable Single-Net Straw Blanket, or alternative approved in advance by IPL.

PART 3 – EXECUTION

3.1 EXAMINATION

A. ASSOCIATED WORK:

1. Verify that the following items have been accomplished prior to beginning this Work:
 - a. That IPL has obtained all necessary permits.
 - b. The requirements outlined in Subsection 02200 (Site Preparation) have been or are in the process of being implemented.
 - c. Utility locate has been performed in accordance with these Specifications and all IPL safety requirements.
2. The Contractor shall coordinate initiation of construction in each of the Work areas with IPL's Representative to ensure that there will be no conflict with other construction and/or plant operations.

B. LAYOUT

1. Secure the services of a land surveyor licensed in the State of Indiana to perform layout and construction staking required on this project including, but not limited to, laying out and staking of the earthwork areas as indicated in the Drawings and any staking requested by IPL's Representative for

maintaining the integrity of the Work. In addition, the centerline flowline of all open channels and diversion berms shall be staked on a 50 ft spacing, or closer if requested by IPL. Information regarding existing benchmarks for horizontal and vertical control located near the project will be provided upon request.

GPS equipment is required for layout and construction controls. All earthwork operations shall be performed with GPS machine guidance and control technology, unless otherwise approved by IPL. IPL will provide a three-dimensional CAD model for use with GPS machine control and guidance.

2. Establish and maintain lines, elevations and general reference points. Verify dimensions indicated in the Drawings. Should conflicts exist, notify IPL's Representative before continuing the Work.

3.2 EXCAVATION

A. GENERAL

1. As noted on the Drawings, it will be necessary to regrade the existing surface of Ash Pond B and a portion of Ash Pond C to establish the final cover subgrade.
2. Excavation shall conform to the dimensions and elevations indicated in the Drawings, except as specified herein or as directed by IPL's Representative. Boundaries of Regulated Waters shall be defined and demarcated by IPL's Representative prior to commencement of excavation activities. Maintaining these boundaries and necessary demarcation to prevent inadvertent impacts to Regulated Waters shall be the responsibility of the Contractor during the entire duration of the project.
3. Unless otherwise noted, the elevations noted in the Drawings are final grades for this phase of the work. Therefore, in some areas it will be necessary to extend the excavations to accommodate the placement of the soil structural fill layer, the protective layer and the vegetative layer. No additional payment shall be made for this excavation.
4. Over-excavation of unsuitable soils shall only be done at the direction of IPL's Representative. In general, over-excavation is not anticipated within the limits of the Ash Pond B.
5. Unauthorized excavation consists of removal of materials beyond the elevations and dimensions noted in the Drawings without the specific direction of IPL's Representative. Unauthorized excavation, as well as the resulting remedial work, shall be done at the Contractor's expense. Backfilling of unauthorized excavations shall be as specified for authorized excavations, unless otherwise directed by IPL's Representative.
7. Implement both Erosion and Dust Control Plans.

B. USE OF EXCAVATED MATERIALS

1. Materials excavated from each of the Work areas shall be utilized as follows unless otherwise directed by IPL's Representative.
 - a. Soils excavated from within the footprint of Ash Pond B or C shall be utilized as structural fill to establish the final cover subgrade. Any vegetated soils removed to establish the subgrade elevations shall be placed a minimum of 5 ft below the final cover subgrade elevation.
 - b. Any CCR materials excavated from the Ash Pond B Project Area shall be placed and compacted as structural fill in either Ash Pond B, or in Ash Pond C at a location approved in advance by IPL. Any excess CCR materials or cover soils that have been in contact with CCR materials that are not

needed to establish the final cover grades noted on the Drawings shall be transported and placed in the Ash Pond C, as directed by IPL.

3.3 EXCESS WATER CONTROL

A. INCLEMENT WEATHER

1. Do not place or spread CCR materials, soil structural fill, protective layer soils, or vegetative layer soils during inclement weather conditions unless otherwise directed to do so by IPL's Representative.
2. Do not resume filling operations until moisture content and density of placed materials are acceptable to IPL's Representative.

B. FLOODING

1. Promptly remove all water collected in depressions. All surface water that has been in contact with the CCR materials must be discharged to either Ash Pond A or C. The discharge of contact water to any other location is strictly prohibited without the written approval of IPL.

C. SOFTENED SUBGRADE

1. Where fill materials have been softened or eroded by flooding or placement during inclement weather, remove all damaged areas and replace with additional fill materials placed in accordance with these Specifications at no additional cost to IPL.

D. DEWATERING

1. Provide, and maintain at all times during construction, ample means and devices with which to promptly remove and dispose of all water from every source entering excavations or other parts of the Work.
2. Unless otherwise directed by IPL, any water pumped from excavations located outside the solid waste boundary of Ash Ponds B or C (e.g., stilling basins at the toe of slopes) shall be discharged into a temporary dewatering basin or geobag before the water is discharged into the receiving stream. Details for a temporary dewatering basin are provided in the Drawings. Discharges to or within the boundaries of Regulated Waters are not permissible in any circumstance without prior approval of IPL.
3. Prior to April 1, 2018, any water that has been in contact with CCR materials in Ash Pond B or portions of Ash Pond C must be collected and discharged to either Ash Pond A or C. The release or discharge of any contact water from the Ash Pond B or Ash Pond C into drainage ditches or other bodies of water is strictly prohibited unless approved in writing by IPL. The ponding of water within the limits of Ash Pond B is strictly prohibited.
4. Following April 1, 2018, any water that has been in contact with the CCR materials in Ash Pond B or Ash Pond C must be collected and pumped to a location identified by IPL.

3.4 FILLING, BACKFILLING AND COMPACTING

A. GENERAL

1. Initial Placement
 - a. CCR materials utilized as structural fill at locations in excess of 5 ft from the final cover geomembrane elevation shall be placed and compacted in lifts not exceeding 2 ft in thickness. CCR

materials utilized as structural fill at locations within 5 ft of the final cover geomembrane elevation shall be placed and compacted in lifts not exceeding 1 ft in thickness.

- b. Prior to the placement of the 30 inch thick protective layer over the geosynthetics, the Contractor shall notify the Soil QAC that the subgrade is ready to be surveyed. IPL's surveyor must document the combined thickness of the protective layer and the vegetative layer placed over the geosynthetics in the final cover area is a minimum of 3 ft. The thickness surveys shall be accomplished by comparing the elevation of the subgrade to the elevation of the top of various layers on a 200 ft by 200 ft grid. No additional Work may proceed without the direction of IPL's Representative after his review of the initial survey information and acceptance of the subgrade by the Soil QAC. The results of this survey will be utilized to verify the combined thickness of the protective layer and the vegetative layer for inclusion in the CQA Report for review by IDEM.
 - c. Natural soils used to construct the protective soil layer shall be placed in 30 inch lifts with minimal compaction, unless otherwise directed by IPL's Representative.
 - d. Placement of soil layer materials on the geosynthetics shall be limited to ambient temperatures ranging between 32°F (0°C) and 120°F (41°C) unless otherwise specified.
 - e. Equipment used for placing vegetative material shall not be driven directly on the geosynthetics.
 - f. A minimum thickness of 1 ft of protective material is specified between a low ground pressure dozer (maximum contact pressure of 8 lb/sq inch) and the geosynthetics.
 - g. In any areas traversed by heavy construction, any vehicles other than low ground pressure vehicles approved by the Project Manager, the protective layer material shall have a minimum thickness of 3 ft. This requirement may be waived if provisions are made to protect the geosynthetics through an engineered design. Drivers shall proceed with caution when on the overlying drainage material and prevent spinning of tires, sharp turns and quick starts or stops.
2. Moisture
 - a. Frozen materials shall not be placed in the soil structural fill layer, the protective soil layer or the vegetative soil layer.
 - b. Structural fill, protective layer soils, vegetative layer soils and/or soils used to construct the diversion berms shall not be placed on frozen materials.
3. Compaction
 - a. Compaction of materials placed in the protective layer and the vegetative layer shall be minimized.
 - b. All natural soil materials placed as backfill in trench excavations, shall be compacted in nominal 12 inch lifts to at least 95 percent of the standard Proctor maximum dry density (ASTM D-698), unless otherwise directed by IPL's Representative.
 - c. All natural soil materials placed as structural fill shall be compacted in nominal 12 inch (loose) lifts to at least 95 percent of the standard Proctor maximum dry density (ASTM D-698), unless otherwise directed by IPL's Representative.

- d. CCR materials utilized as structural fill at locations in excess of 5 ft from the final cover geomembrane elevation shall be placed in two foot lifts (maximum) and compacted with a minimum of three passes (back and forth) of a smooth drum compactor.
 - e. CCR materials utilized as structural fill at locations within 5 ft of the final cover geomembrane elevation shall be placed in one foot lifts (maximum). The required number of passes of the compaction equipment will be established by the construction of a test pad prior to the start of the Earthwork phase of the project. Contractor shall work with IPL and its representatives to prepare test pad, as directed by IPL, at no additional cost.
- 4. Testing
 - a. Compaction testing of structural fill shall be performed by the Soil QAC contracted by IPL.
 - b. The frequency of testing shall be directed by IPL in consultation with the Soil QAC.
 - c. At the discretion of either IPL or the Soil QAC, field density and field moisture content testing shall periodically be compared to laboratory values of density and moisture contents so that the field measurements can be adjusted to better match laboratory results.
 - d. Compaction testing will not be performed on the CCR structural fill materials.

B. WORK AREA SEQUENCE/SPECIFIC REQUIREMENTS

- 1. Following implementation of all necessary erosion control measures, the remainder of the Work shall follow in the general sequence outlined below, unless otherwise directed by IPL.
 - a. Installation of surface water drainage controls within the Ash Pond B/C work area to prevent the release or discharge of contact water to areas other than Ash Pond A or C.
 - b. Final grading of CCR materials to establish the final cover subgrade.
 - c. Excavation of toe drain trenches and anchor trenches associated with the geosynthetic installation.
 - d. Installation of drop inlet structures and down drain pipes, and construction of outlet channels and plunge pools.
 - e. Installation of the protective layer over the geosynthetics.
 - f. Installation of the vegetative layer over the protective layer.
 - g. Completion of the erosion control berms.
 - h. Vegetation of the surface of the final cover, the erosion control berms, and all other areas disturbed by the Contractor during this project.
- 2. The vegetative layer and diversion berms shall be constructed and vegetated as soon as practical following the approved installation of the geosynthetic materials.

3.5 PROTECTIVE LAYER/VEGETATIVE LAYER

- A. The elevations noted on the Drawings are final grades for this phase of the work unless otherwise noted. The Contractor shall account for the thickness of the protective layer and the vegetative layer while establishing the subgrade surface of all excavations and fills.

- B. The material used in the construction of the protective layer and vegetative layer shall be obtained from off-site borrow source(s) approved in advance by IPL.
- C. Care shall be taken to keep heavy equipment off the protective layer and the vegetative layer materials after it has been spread.
- D. The protective and vegetative layers shall be applied to all areas disturbed during this project with the exception of the following:
 - 1. Areas to be covered by riprap.
 - 2. Areas to be covered by gravel.
- E. The soil placed in the protective layer below the vegetative layer shall be spread in one 30 inch lift to minimize its compaction. The combined thickness of the protective layer and the vegetative layer shall be a minimum of 36 inches.
- F. The vegetative layer shall be spread in one lift. The minimum thickness of the vegetative layer, where required, is 6 inches.

END OF SUBSECTION

DIVISION 2 – CIVIL/STRUCTURAL

SUBSECTION 02712 - NONWOVEN GEOTEXTILES

PART 1 – GENERAL

1.1 WORK DESCRIPTION

A. WORK INCLUDED

1. The Contractor shall furnish all labor, materials, tools, supervision, transportation, and installation equipment necessary for the installation of geotextiles, as specified herein, as shown on the Drawings, and in accordance with the Quality Assurance Manual (QAM).
2. The Contractor shall be prepared to install geotextiles in conjunction with the other components of the final cover system.
3. As noted on the Drawings, the geotextile will be utilized in conjunction with the geocomposite to form a cushion layer/drainage layer over the geomembrane. The geotextile will also be utilized in the construction of other drainage features, as noted on the Drawings.
4. If conflicts arise between the requirements of this specification and the requirements of the Quality Assurance Manual (QAM, March 2017) then the QAM requirements shall be used.

B. RELATED WORK SPECIFIED ELSEWHERE

1. Subsection 02713: Geocomposite Drainage Layer
2. Subsection 02778: LLDPE Geomembrane
3. Subsection 15150: Drainage Pipes

C. REFERENCES

1. Quality Assurance Manual, March 2017.
2. Latest version of American Society for Testing and Materials (ASTM), Geosynthetic Institute (GSI), and other standards:
 - a. ASTM D5261, "Standard Test Method for Measuring Mass Per Unit Area of Geotextiles".
 - b. ASTM D3786, "Standard Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabric – Diaphragm Bursting Strength Tester Method".
 - c. ASTM D4355, "Standard Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus)".
 - d. ASTM D4491, "Standard Test Method for Water Permeability of Geotextiles by the Permittivity Method".
 - e. ASTM D4533, "Standard Test Method for Trapezoid Tearing Strength of Geotextiles".
 - f. ASTM D4632, "Standard Test Method for Breaking Load and Elongation of Geotextiles (Grab Method)".
 - g. ASTM D4751, "Standard Test Method for Determining Apparent Opening Size of a Geotextile".

- h. ASTM D6241, "Standard Test Method for Static Puncture Strength of Geotextiles, and Geotextile-Related Products using a 50-mm Probe".
- 3. Daniel, D.E. and R.M. Koerner, (1993), *Technical Guidance Document: Quality Assurance and Quality Control for Waste Containment Facilities*, EPA/600/R-93/182.

D SUBMITTALS

- 1. The Contractor shall submit to IPL's Representative the following information on geotextile production:
 - a. Manufacturing quality control certificates shall be signed by responsible parties employed by the Manufacturer (such as the production manager).
 - b. The quality control certification shall include:
 - i. manufacturer's name;
 - ii. product information;
 - iii. roll number;
 - iv. roll dimensions;
 - v. results of quality control tests (as required by these Specifications and the QAM), including a description of the test methods used.

E. CONSTRUCTION QUALITY ASSURANCE

- 1. The installation of geotextiles shall be monitored as specified in this section and as outlined in the Quality Assurance Manual (QAM).
- 2. The Contractor shall be aware of the activities outlined in the QAM and shall account for these CQA activities in the installation schedule.

PART 2 – PRODUCTS

2.1 GEOTEXTILE

A. PROPERTIES

- 1. All Manufacturer's material properties must be approved by IPL's Representative.
- 2. Unless otherwise noted, geotextile suppliers shall furnish materials whose test values meet or exceed the criteria in these Specifications. The Manufacturer shall provide test results for these procedures, as well as the necessary certification that the material properties meet or exceed the specified values. The supplier shall not furnish products specifically manufactured to meet the specifications of this project unless authorized by IPL.
- 3. Where applicable, Minimum Average Roll Value (MARV) shall be based on Manufacturer's data and shall be calculated as the mean value of the property of interest plus or minus two standard deviations, as appropriate or as approved by IPL's Representative. Where material properties vary among the machine and cross-machine directions, the MARV shall apply to the direction providing the lowest value (when a minimum is specified) or the highest value (when a maximum value is specified).
- 4. In addition to the property values listed in these Specifications, the geotextile shall retain their structure during handling, placement, and long-term service.

B. PACKING AND LABELING

1. Geotextiles shall be supplied in rolls wrapped in relatively impermeable and opaque protective covers and marked or tagged with the following information:
 - a. manufacturer's name;
 - b. product information;
 - c. lot or batch number;
 - d. roll number; and
 - e. roll dimensions.
2. If any special handling is required, it shall be so marked on the geotextile itself; e.g., "This Side Up" or "This Side Against Soil to be Retained".

C. TRANSPORTATION

1. Transportation of the geotextiles is the responsibility of the Contractor. The Contractor shall be liable for all damages to the materials incurred prior to and during transportation to the site.

D. HANDLING AND STORAGE

1. Handling, storage, and care of the geotextiles prior to and following installation at the site, is the responsibility of the Contractor. The Contractor shall be liable for all damages to the materials incurred prior to final acceptance of the lining system by IPL.
2. The Contractor shall be responsible for storage of the geotextile materials at the site, at locations approved in advance by IPL.
3. The geotextiles shall be protected from sunlight, moisture, excessive heat or cold, puncture, or other damaging or deleterious conditions. The geotextile shall be protected from mud, dirt and dust. Any additional storage procedures required by the Manufacturer shall be the Contractor's responsibility.

E. MANUFACTURING QUALITY CONTROL

1. The Manufacturer shall sample and test the geotextile material, at minimum frequencies specified in the table at the end of this section to demonstrate that the material conforms to the requirements of these Specifications. At a minimum, the Contractor shall comply with the submittal requirements of these Specifications. Test results shall be submitted to the Geosynthetic QAC and IPL prior to shipping the geotextile.
2. Sampling shall, in general, be performed on sacrificial portions of the geotextile material such that repair is not required. The Contractor shall require that the Geotextile Manufacturer sample and test the geotextile at the frequencies presented in the Geotextile Manufacturer's Quality Control Plan. In addition, the Contractor shall ensure that the tests are performed at the frequencies shown in the table at the end of this section to demonstrate that the properties conform to the values specified in this table.
3. If the results contained in the manufacturer's certifications do not meet or exceed the quality control requirements of these Specifications, the material shall be considered out-of-specification and rejected. At the option of IPL, additional testing may be performed at the manufacturer's expense to "bracket" the portion of the non-conforming materials or to qualify individual rolls. This procedure is valid only when the rolls of material are consecutively produced and numbered from one manufacturing line. To isolate the out-of-specification material, additional samples may be taken from the rolls that have roll numbers immediately prior to and following the roll that was sampled and failed. If both additional tests pass, the roll represented by the initial failed test shall be rejected. If one or both of the additional

tests fail, the material from that lot shall be rejected unless additional testing is approved by the Owner and the Geosynthetic QAC.

4. The Contractor shall require that the Geotextile Manufacturer comply with the certification and submittal requirements of the project specifications.

PART 3 – EXECUTION

3.1 CONSTRUCTION ACTIVITIES

A. GENERAL

1. Prior to implementing any of the work described in this Section, the Contractor shall become thoroughly familiar with all portions of the work within this Section, including the QAM, as necessary for successful completion of the Work.
2. The Contractor shall carefully inspect the surface prepared to receive the geotextile and verify that all work is complete to the point where the installation of the geotextile may properly commence without adverse impact.
3. If the Contractor has any concerns regarding the installed work performed in preparation for the installation of the geotextile, he/she shall notify the Geosynthetic QAC in writing within 48-hours of his site inspection. Failure to inform either the Geosynthetic QAC or IPL in writing of installation of the geotextile will be construed as Contractor's acceptance of the surface prepared to receive the geotextile.

3.2 GEOTEXTILE INSTALLATION

A. CONFORMANCE TESTING

1. Conformance testing shall be performed on the geotextile at the frequencies noted in these Specifications.
2. Prior to shipping the material to the site, samples of the geotextile shall be removed by the Geosynthetic QAC or his designee and sent to an independent laboratory selected by IPL's Representative for testing to ensure conformance to the requirements of this Section.
3. Selection of samples shall be determined by the Geosynthetic QAC, in accordance with this Section and the procedures outlined in the QAM.
4. The Geosynthetic QAC may increase the frequency of sampling to isolate non-conforming materials in the event that test results do not comply with requirements contained in these specifications. This additional testing shall be performed at the expense of the Contractor.
5. Any geotextile that is not certified in accordance with these Specifications, or if the results of Conformance Testing do not comply with these Specifications, the geotextile shall be rejected and replaced with new material in accordance with the Specifications, at no additional cost to IPL.

B. HANDLING AND PLACEMENT

1. The Contractor shall handle all geotextile in such a manner as to ensure they are not damaged in any way.

2. The Contractor shall take any necessary precautions to prevent damage to underlying layers during placement of the geotextile.
3. After unwrapping the geotextile from its opaque cover, the geotextile shall not be left exposed for a period in excess of 15 days unless a longer exposure period is approved by the Geosynthetic QAC, based on a formal demonstration from the Contractor that the geotextile is stabilized against U.V. degradation for the proposed period of exposure.
4. If white colored geotextile is used, precautions shall be taken against "snow blindness" of personnel.
5. The Contractor shall take care not to entrap stones, excessive dust, or moisture in the geotextile during placement.
6. The Contractor shall secure all geotextiles with sandbags, or the equivalent, in the presence of wind. Such sandbags shall be installed during placement and shall remain until replaced with protective soil cover or other components of the liner system. Sand bags shall be removed from the geotextile prior to placement of the other materials over the geotextile.
7. The Contractor shall examine the entire geotextile surface after installation to ensure that no potentially harmful foreign objects are present. The Contractor shall remove any such foreign objects and shall replace any damaged geotextile at no expense to IPL.

C. SEAMS AND OVERLAPS

1. As noted on the Drawings, three adjoining panels of geotextile shall be installed followed by a panel of geocomposite material. The maximum distance between the centers of the geocomposite strips shall be 60 ft. The geotextile will also be utilized in other drainage features, as noted on the Drawings.
2. All nonwoven geotextiles shall be continuously sewn (i.e., spot sewing is not allowed). This includes seams attached to the geocomposite material. The nonwoven geotextile shall be sewn to the top geotextile of the geocomposite material. Geotextiles shall be overlapped a minimum of 6 inches prior to seaming. No horizontal seams shall be allowed on slopes equal to or steeper than 5 horizontal to 1 vertical (i.e., seams shall be along, not across, the slopes). Other seaming techniques may be approved by IPL's Representative or the Geosynthetic QAC.
3. All "butt" seams or "end of roll seams" shall be staggered at least 5 ft on slopes equal to or steeper than 5H to 1V, or at the discretion of the Geosynthetic QAC.
4. Polymeric thread, with chemical resistance properties equal to or exceeding those of the nonwoven geotextile, shall be used for all sewing. The seams shall be sewn to provide a flat (prayer) seam, "J" seam, or "butterfly-folded" seam and shall be a two thread, double-lock stitch or a double row of single-thread, chain stitch.
5. When sewing a flat seam, the stitching shall be approximately 1-1/2 inches ($\pm 1/4$ ") from the outside edge of this fabric. The "J" fold and Butterfly fold seams require a fold 1-1/4 inches to 2 inches from the fabric edge with the stitching approximately 1 inch from the folded edge.
6. During placement of geotextile in contact with geomembrane, care will be taken not to entrap stones, sharp objects, or broken needles that could damage geomembrane.

D. REPAIR

1. Any holes or tears in the geotextile shall be repaired as follows:

- a. On slopes steeper than 5 horizontal to 1 vertical, a patch made from the same geotextile shall be sewn into place if deemed necessary by the Geosynthetic QAC.
 - b. On slopes flatter than or equal to 5 horizontal to 1 vertical a patch made from the same geotextile shall be sewn or heat-bonded in place. Heat bonding shall only be performed on "relatively" small patches, with the approval of the Geosynthetic QAC.
 - c. Sewing shall be required on relatively large patches as determined by the Geosynthetic QAC.
2. Care shall be taken to remove any soil or other material which may have penetrated the torn geotextile.

3.3 PRODUCT PROTECTION

1. The Contractor shall use all means necessary to protect all prior work and materials and completed work of other Sections.
2. In the event of damage, the Contractor shall immediately make all repairs and replacements necessary, to the approval of the Geosynthetic QAC and at no additional cost to IPL.

**Table for 12 oz/sy Nonwoven Geotextile
Testing Summary**

Properties	Test Method	Manufacturer QC Test Frequency	Conformance QA Test Frequency ⁽²⁾	Required Test Values
Mass/Unit Area (min. ave.)	ASTM D5261	1 per 100,000 sf	1 per 250,000 sf	12.0 oz/sy
Apparent Opening Size ⁽¹⁾ (max.)	ASTM D4751	1 per 500,000 sf	1 per 500,000 sf	0.212 mm
Grab Strength (min. ave.)	ASTM D4632	1 per 100,000 sf	1 per 250,000 sf	300 lbs
Trapezoidal Tear Strength	ASTM D4533	1 per 100,000 sf	N/A	115 lbs
Puncture Strength (min. ave.)	ASTM D6241	1 per 100,000 sf	1 per 250,000 sf	900 lbs
UV Resistance	ASTM D4355	1 per resin formulation	N/A	70% ⁽³⁾
Permittivity ⁽¹⁾ (min.)	ASTM D4491	1 per 500,000 sf	1 per 500,000 sf	0.7 sec ⁻¹

Notes:

- (1) AOS and Permittivity shall only be tested for geotextiles used in filter applications.
- (2) Frequency to be utilized if conformance testing is requested by Geosynthetic QAC or IPL.
- (3) After 500 hours of exposure.

END OF SUBSECTION

SUBSECTION 02713 - GEOCOMPOSITE DRAINAGE LAYER

PART 1 – GENERAL

1.1 WORK DESCRIPTION

A. WORK INCLUDED

1. The Contractor shall ensure that all pre-construction testing, including conformance testing and interface friction testing, has been completed and approved by the QAC prior to shipping the material to the job site.
2. The Contractor shall furnish all labor, materials, tools, supervision, transportation, and equipment necessary for the installation of a geocomposite drainage layer as specified herein, as shown on the Drawings, and in accordance with the Quality Assurance Manual.
3. The Contractor shall be prepared to install the geocomposite drainage layer in conjunction with other components of the final cover system. It is noted that the geocomposite drainage layer will be placed in strips in the final cover area, as noted on the Drawings.
4. If conflicts arise between the requirements of this specification and the requirements of the Quality Assurance Manual (QAM, March 2017) then the QAM requirements shall be used.

B. RELATED WORK SPECIFIED ELSEWHERE

1. Subsection 02300: Earthwork
2. Subsection 02712: Nonwoven Geotextiles
3. Subsection 02778: LLDPE Geomembrane

C. REFERENCES

1. Quality Assurance Manual, March 2017.
2. Latest version of American Society for Testing and Materials (ASTM), Geosynthetic Institute (GSI), and other standards:
 - a. ASTM D1238, "Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer".
 - b. ASTM D1505, "Standard Test Method for Density of Plastics by the Density-Gradient Technique".
 - c. ASTM D4716, "Standard Test Method for Constant Head Hydraulic Transmissivity (In-Plane Flow) of Geotextiles and Geotextile Related Products".
 - d. ASTM D4218, "Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique".
 - e. ASTM D1603, "Standard Test Method for Carbon Black in Olefin Plastics".
 - f. ASTM D3786, "Standard Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabric – Diaphragm Bursting Strength Tester Method".

- g. ASTM D4355, "Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus".
- h. ASTM D4491, "Standard Test Method for Water Permeability of Geotextiles by the Permittivity Method".
- i. ASTM D4533, "Standard Test Method for Trapezoid Tearing Strength of Geotextiles".
- j. ASTM D4632, "Standard Test Method for Breaking Load and Elongation of Geotextiles (Grab Method)".
- k. ASTM D4751, "Standard Test Method for Determining Apparent Opening Size of a Geotextile".
- l. ASTM D6241, "Standard Test Method for Static Puncture Strength of Geotextiles and Geotextile-Related Products using a 50 mm Probe".
- m. ASTM D5261, "Standard Test Method for Measuring Mass per Unit Area of Geotextiles".
- n. ASTM D7005, "Standard Test Method for Determining the Bond Strength (Ply adhesion) of Geocomposites".
- o. ASTM D5199, "Standard Test Method for Measuring the Nominal Thickness of Geosynthetics".

D SUBMITTALS

- 1. The Contractor shall submit to IPL's Representative the following information on geocomposite drainage layer production:
 - a. Manufacturing quality control certificates shall be signed by responsible parties employed by the Manufacturer (such as the production manager).
 - b. The quality control certificate shall include:
 - i. manufacturer's name;
 - ii. product information;
 - iii. roll number;
 - iv. roll dimensions;
 - v. results of quality control tests (as required by the QAM and these Specifications), including a description of the test methods used.

E. CONSTRUCTION QUALITY ASSURANCE

- 1. The installation of the geocomposite drainage layer shall be monitored as specified in these Specifications and as outlined in the Quality Assurance Manual.
- 2. The Contractor shall be aware of the activities outlined in the QAM and shall account for these CQA activities in the installation schedule.
- 3. The Contractor shall submit to the Geosynthetic QAC in writing the following documentation on the raw materials used to manufacture the geocomposite prior to transporting any geocomposite to the site:
 - a. Copies of quality control certificates issued by the resin supplier including production dates of the resin.

- b. Results of tests conducted to verify the quality of the resin used to manufacture the geocomposite drainage layer rolls assigned to the project.
 - c. Certification that no reclaimed polymer is added to the resin during the manufacture of the geocomposite drainage layers to be used in this project.
4. The geotextile and geocomposite components shall meet these project specifications. Quality Control Testing of the geotextile and geocomposite shall be in accordance with the project specifications.

PART 2 – PRODUCTS

2.1 GEOCOMPOSITE DRAINAGE LAYER

A. PROPERTIES

1. The Manufacturer shall furnish geocomposite having properties that comply with the required property values shown in the table attached at the end of this section. The Manufacturer shall provide test results for these procedures, as well as certification that the materials meet or exceed the specified values.
2. In addition to the property values listed in the table attached at the end of this section, the geocomposite shall:
 - a. Retain its structure during handling, placement, and long-term service.
 - b. Be capable of withstanding outdoor exposure for a minimum of 30 days with no measurable deterioration.

B. MANUFACTURING QUALITY CONTROL

1. The geocomposite shall be manufactured with quality control procedures that meet generally accepted industry procedures.
2. The Contractor shall require that the Geocomposite Manufacturer sample and test the geocomposite to demonstrate that the material conforms to the requirements of these Specifications. Test results shall be submitted to the Geosynthetic QAC and IPL prior to shipping the geocomposite to the project site.
3. Sampling shall, in general, be performed on sacrificial portions of the geocomposite material such that repair is not required. The Contractor shall require that the Geocomposite Manufacturer sample and test the geocomposite at the frequencies presented in the Geocomposite Manufacturer's Quality Control Plan. In addition, the Contractor shall ensure that the tests are performed at the frequencies shown in the table at the end of this section to demonstrate that the properties conform to the values specified in this table.
4. If the results contained in the manufacturer's certifications do not meet or exceed the quality control requirements of these Specifications, the material shall be considered out-of-specification and rejected. At the option of IPL, additional testing may be performed at the manufacturer's expense to "bracket" the portion of the non-conforming materials or to qualify individual rolls. This procedure is valid only when the rolls of material are consecutively produced and numbered from one manufacturing line. To isolate the out-of-specification material, additional samples may be taken from the rolls that have roll numbers immediately prior to and following the roll that was sampled and failed. If both additional tests pass, the roll represented by the initial failed test shall be rejected. If one or both of the additional tests fail, the material from that lot shall be rejected unless additional testing is approved by the Owner and the Geosynthetic QAC.

5. The Contractor shall require that the Geocomposite Manufacturer comply with the certification and submittal requirements of the project specifications.

C. LABELING

1. Geocomposite shall be supplied in rolls wrapped in relatively impermeable and opaque protective covers.
2. Geocomposite rolls shall be labeled with the following information:
 - a. manufacturer's name;
 - b. product information;
 - c. lot or batch number;
 - d. roll number; and
 - e. roll dimensions.
3. If any special handling is required, it shall be so marked on the geotextile component e.g., "This Side Up" or "This Side Against Soil To Be Retained".

D. TRANSPORTATION

1. Transportation of the geocomposite shall be the responsibility of the Manufacturer. The Manufacturer shall be liable for all damages to the materials incurred prior to and during transportation to the site. The Contractor shall be liable for all damages to the materials incurred during on-site storage, installation and prior to final acceptance by IPL.

E. HANDLING AND STORAGE

1. Handling, storage, and care of the geocomposite prior to and following installation at the site, is the responsibility of the Contractor. The Contractor shall be liable for all damages to the materials incurred prior to final acceptance of the lining system by IPL.
2. The Contractor shall be responsible for storage of the geocomposite at the site. The geocomposite shall be stored on a prepared surface at a location approved in advance by IPL. The geocomposite shall be protected from direct sunlight, excessive heat or cold, mud, dirt, and dust. Any additional storage procedures required by the Manufacturer shall be the Contractor's responsibility.

PART 3 – EXECUTION

3.1 CONSTRUCTION ACTIVITIES

A. GENERAL

1. Prior to implementing any of the work described in this Section, the Contractor shall become thoroughly familiar with all portions of the work falling within this Section and the QAM.
2. The Contractor shall carefully inspect the surface prepared to receive the geocomposite drainage layer and verify that all work is complete to the point where the installation of the geocomposite drainage layer may properly commence without adverse impact.
3. If the Contractor has any concerns regarding the installed work performed in preparation for the installation of the geocomposite drainage layer, he/she shall notify the Geosynthetic QAC. Failure to inform the Geosynthetic QAC of installation of the geocomposite will be construed as Contractor's acceptance of the surface prepared for the installation of the geocomposite drainage layer.

3.2 GEOCOMPOSITE INSTALLATION

A. CONFORMANCE TESTING

1. Prior to shipping the materials to the site, samples of the geocomposite shall be removed by the Geosynthetic QAC, or its representative, and sent to a third party laboratory selected by the Geosynthetic QAC for testing to ensure conformance to these Specifications.
2. Sample locations and tests shall be coordinated by the Geosynthetic QAC in accordance with these Specifications.
3. Samples shall be taken at the designated rate and tested for the properties presented in the table at the end of this section.
4. The Geosynthetic QAC may increase the frequency of sampling in the event that test results do not comply with these Specifications. This additional testing shall be performed at the expense of the Contractor.
5. Any geocomposites that are not certified in accordance with these Specifications, or that conformance testing indicates do not comply with these Specifications shall be rejected and replaced, with new material, by the Contractor at no additional cost to IPL.

B. HANDLING AND PLACEMENT

1. The Contractor shall handle all geocomposite in such a manner as to ensure the geocomposite drainage materials are not damaged in any way.
2. The Contractor shall take any necessary precautions to prevent damage to underlying layers during placement of the geocomposite.
3. All geocomposite shall be secured with sandbags or the equivalent until seamed together or secured in an anchor trench, or secured by placement of final cover soils. Such sandbags shall be installed during placement and shall remain until replaced with cover material. Sand bags shall be removed from the geocomposite prior to placement of the protective soil cover.
4. On the side slopes, the geocomposite shall be secured in the anchor trench and then rolled down the slope in such a manner as to continually keep the geocomposite in tension.
5. If necessary, the geocomposite shall be positioned by hand after being unrolled to minimize wrinkles.
6. Care shall be taken during placement of geocomposite not to entrap dirt or excessive dust in the geocomposite that could cause clogging of the drainage system, and/or stones that could damage the geocomposite or the adjacent liner. If soil or excessive dust is entrapped in the geocomposite, it shall be cleaned prior to placement of the next material on top of it. Care shall be exercised when handling sandbags, to prevent rupture or damage of the sandbags.
7. Geocomposite shall only be cut using Manufacturer's recommended procedures.
8. Unless otherwise specified, geocomposite shall not be welded to liners.
9. Tools shall not be left on, in, or under the geocomposite.
10. After unwrapping the geocomposite from its opaque cover, the geocomposite shall not be left exposed for a period in excess of 15 days unless a longer exposure period is approved by the Geosynthetic QAC

based on a formal demonstration from the Contractor and Supplier that the geotextile component of the geocomposite is stabilized against U.V. degradation for a period in excess of 15 days. The extension period shall not exceed 10 days.

11. If white colored geotextile is used in the geocomposite, precautions shall be taken against "snow blindness" of personnel.
12. Where indicated, an anchor trench (as illustrated on the Contract Drawings) will be required at the liner perimeter to secure the Geocomposite. The time schedule for excavation and backfilling of the anchor trench is to be approved by IPL so that excessive desiccation of trench soils does not occur prior to backfilling.

C. SEAMS AND OVERLAPS

1. Adjacent geocomposite shall be overlapped so that the geonet overlaps by at least 4 inches and geotextile overlaps by at least 3 inches.
2. The geonet overlaps shall be tied with plastics fasteners. Tying devices shall be white or yellow for easy inspection. Metallic devices are not allowed.
3. Tying shall be every 5 ft along the slope, every 6 inches in the anchor trench, and every 6 inches along end-to-end seams.
4. Once geonet is tied, the top geotextile of the geocomposite shall be seamed. All geotextiles shall be continuously sewn. Spot sewing is not allowed. Installer shall pay particular attention to seams to ensure that no earth cover material could be inadvertently inserted beneath the geotextile if applicable.
5. Any sewing shall be done using polymeric thread with chemical and ultraviolet light resistance properties equal to or exceeding those of the geotextile. Sewing shall be done using machinery and stitch types approved by the Geosynthetic QAC.
6. All geocomposite roll ends (butt seams) shall be overlapped a minimum of one foot. Ties shall be applied at 6 inch intervals. A geotextile patch shall be thermally bonded over the tie locations.
7. All "butt" seams and "end of roll" seams shall be staggered at least 5 ft on slopes equal to or steeper than 5H to 1V, or at the discretion of the Geosynthetic QAC.
8. If the geotextile and geonet of the geocomposite roll ends (butt seams) are not bonded, the geonet shall be overlapped a minimum of 6 inches and tied with fasteners as noted above. The top geotextile layer of the geocomposite shall be overlapped a minimum of 4 inches and continuously sewn. The bottom layer of geotextile shall be overlapped to provide protections for the underlying geomembrane.
9. Polymeric thread, with chemical resistance properties equal to or exceeding those of the geotextile component, shall be used for all sewing. The seams shall be sewn to provide a flat (prayer) seam, "J" seam, or "butterfly-folded" seam and shall be a two-thread, double-lock stitch or a double row of single-thread, chain stitch.

D. REPAIR

1. Any holes or tears in the geocomposite shall be repaired by placing a patch extending 1 ft beyond the edges of the hole or tear. The patch shall be secured by tying fasteners through the bottom geotextile and the geonet of the patch, and through the top geotextile and geonet of the damaged geocomposite. The patch shall be secured every 6 inches with approved tying devices. The top geotextile component of the patch shall be heat sealed to the top geotextile of the geocomposite needing repair. If the hole or

tear width across the roll is more than 50 percent of the width of the roll, the damaged area shall be cut out and the two portions of the geocomposite shall be joined in accordance with these Specifications.

E. PRODUCT PROTECTION

1. The Contractor shall use all means necessary to protect all prior work, and all materials and completed work of other Sections.
2. In the event of damage, the Contractor shall immediately make all repairs and replacements necessary, to the approval of the CQA Consultant and at no additional cost to IPL.

**Table for Liner System Geocomposite-250mil
Testing Summary**

Geonet Component

Properties	Test Method	Manufacturer QC Test Frequency	Conformance QA Test Frequency	Required Test Values
Thickness (min. ave.)	ASTM D5199	1 per 50,000 sf	1 per 250,000 sf	250 mil
Density (min. ave.)	ASTM D1505	1 per 50,000 sf	1 per 250,000 sf	0.940 g/cc
Carbon Black Content (range)	ASTM D4218 ⁽³⁾	1 per 50,000 sf	1 per 250,000 sf	2-3%

Geotextile Component

Properties	Test Method	Manufacturer QC Test Frequency	Conformance QA Test Frequency	Required Test Values
Mass/Unit Area (min. ave.)	ASTM D5261	1 per 100,000 sf	1 per 250,000 sf	8 oz/sy
Apparent Opening Size (max.)	ASTM D4751	1 per 500,000 sf	1 per 500,000 sf	0.18 mm
Tensile Strength - Grab (min. ave.)	ASTM D4632	1 per 100,000 sf	1 per 250,000 sf	220 lbs
Puncture Strength (min. ave.)	ASTM D6241	1 per 100,000 sf	1 per 250,000 sf	575 lbs
Trapezoidal Tear	ASTM D4533	1 per 100,000 sf	N/A	115 lbs
UV Resistance	ASTM D4355	1 per resin formulation	N/A	70% ⁽³⁾
Flow Rate	ASTM D4491	1 per 500,000 sf	1 per 500,000 sf	95 gpm/sf
Permittivity (min.)	ASTM D4491	1 per 500,000 sf	1 per 500,000 sf	1.3 sec ⁻¹

Finished Geocomposite Product

Properties	Test Method	Manufacturer QC Test Frequency ⁽²⁾	Conformance QA Test Frequency ⁽²⁾	Required Test Values
Peel Strength (min. ave.)	ASTM D7005	1 per 100,000 sf	1 per 250,000 sf	1.0 lb/in
Transmissivity ₍₁₎ (min. ave.)	ASTM D4716	1 per project	1 per 250,000 sf	2.4 gal/min/ft

Notes:

- (1) Transmissivity shall be measured in a 12-inch x 12-inch box using the same boundary conditions, load, duration and gradient as those used by the manufacturer to establish the min. ave. for the required test value.
- (2) Tracking of the frequency of Manufacturer QC testing and Conformance QA testing shall be based on the geocomposite roll numbers.
- (3) Other methods such as D1603 (tube furnace) or ASTM D6370 (TGA) are acceptable if an appropriate correlation to D4218 (muffle furnace) can be established.

END OF SUBSECTION

SUBSECTION 02778 – LLDPE GEOMEMBRANE

PART 1 – GENERAL

1.1 WORK DESCRIPTION

A. WORK INCLUDED

1. The Contractor shall ensure that all pre-construction testing, including conformance testing and interface friction testing has been completed and approved by the Geosynthetic QAC prior to shipping the material to the job site.
2. The Contractor shall furnish all labor, materials, supervision, and equipment to install the both smooth and textured 40 mil LLDPE geomembrane liner, including, but not limited to liner layout, seaming, repair, and testing, and all necessary and incidental items (such as pipe boots) required to complete the Work, in accordance with the Drawings and these Specifications. It is noted that the geomembrane will be placed within the limits noted on the Drawings.
3. If conflicts arise between the requirements of this specification and the requirements of the Quality Assurance Manual (QAM, March 2017) then the QAM requirements shall be used.

B. RELATED WORK SPECIFIED ELSEWHERE

1. Subsection 02300: Earthwork
2. Subsection 02712: Nonwoven Geotextiles
3. Subsection 02713: Geocomposite Drainage Layer

C. DEFINITIONS

The following list of definitions is provided for reference.

1. "Extrusion Weld" shall mean a bond between two polyethylene (PE) materials which is achieved by extruding a bead of PE over the leading edge of the seam between the upper and lower sheet using a hand held apparatus.
2. "Fusion Weld" shall mean a bond between two polyethylene (PE) materials which is achieved by fusing both PE surfaces in a homogeneous bond of the two surfaces using a power driven apparatus capable of heating and compressing the overlapped portions of the geomembrane sheets.
3. "PE Geomembrane" or "Geomembrane" shall mean a relatively impermeable thin sheet of polyethylene used as a barrier liner or cover to prevent liquid or vapor migration into or from liquid or solid storage facilities.
4. "Textured Geomembrane" shall mean Geomembrane with roughened, high-friction surfaces created by coextrusion, impingement, lamination or other methods approved by the Geosynthetic QAC.
5. "Geosynthetic QAC" shall mean the Quality Assurance Consultant retained by IPL to provide - construction quality assurance services relative to the production and installation of geosynthetic materials.

D. REFERENCES

1. Quality Assurance Manual, March 2017.

2. Latest version of the American Society for Testing and Materials (ASTM), Geosynthetic Institute (GSI), and other standards:
 - a. ASTM D746, "Standard Test Method for Brittleness, Temperature of Plastics and Elastomers by Impact".
 - b. ASTM D751, "Standard Method for Testing Coated Fabric".
 - c. ASTM D792, "Standard Test Methods for Specific Gravity (Relative Density) and Density of Plastics by Displacement".
 - d. ASTM D1004, "Standard Test Method of Initial Tear Resistance of Plastic Film and Sheeting".
 - e. ASTM D1204, "Standard Plastics Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature".
 - f. ASTM D1238, "Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer".
 - g. ASTM D1505, "Standard Test Methods for Density of Plastics by Density-Gradient Technique".
 - h. ASTM D1603, "Standard Test Method for Carbon Black in Olefin Plastics".
 - i. ASTM D1693, "Standard Test Method for Environmental Stress Cracking of Ethylene Plastics".
 - j. ASTM D3895, "Standard Test Method for Oxidative-Induction Time of Polyolefins by Differential Scanning Calorimetry".
 - k. ASTM D4218, "Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds By the Muffle Furnace Technique".
 - l. ASTM D4354, "Standard Practice for Sampling of Geosynthetics for Testing".
 - m. ASTM D4833, "Test Method for Index Puncture Resistance of Geomembranes and Related Products".
 - n. ASTM D5199, "Standard Test Method for Measuring Nominal Thickness of Geosynthetics".
 - o. ASTM D5321, "Standard Test Method for Determining the Coefficient of Soil and Geosynthetic of Geosynthetic and Geosynthetic Friction by the Direct Shear Method".
 - p. ASTM D5323, "Standard Practice for Determination of 2 % Secant Modulus for Polyethylene Geomembranes".
 - q. ASTM D5397 Appendix, "Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test".
 - r. ASTM D5596, "Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics".
 - s. ASTM D5617, "Standard Test Method for Multi-Axial Tension Test for Geosynthetics".
 - t. ASTM D5721, "Standard Practice for Air-Oven Aging of Polyolefin Geomembranes".

- u. ASTM D5885, "Standard Test Method for Oxidative Induction Time of Polyolefin Geosynthetics by High-Pressure Differential Scanning Calorimetry".
 - v. ASTM D5994, "Test Method for Measuring Core Thickness of Textured Geomembranes."
 - w. ASTM D6370, "Standard Test Method for Rubber-Compositional Analysis by Thermogravimetry (TGA)".
 - x. ASTM D6392, "Standard Test Methods for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods".
 - y. ASTM D6693, "Standard Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene geomembrane".
 - z. ASTM D7466, "Standard Test Method for Measuring Asperity Height of Textured Geomembrane".
 - aa. Geosynthetic Institute Test Method GM-6, "Pressurized Air Channel Test for Dual Seamed Geomembranes".
 - bb. Geosynthetic Institute Test Method GM-9, "Cold weather Seaming of Geomembranes".
 - cc. Geosynthetic Institute Test Method GM-17, "Test Methods, Properties, and Testing Frequency for Linear Low Density Polyethylene (LLDPE) Smooth and Textured Geomembranes".
 - dd. Geosynthetic Institute Test Method GM-19, "Seam Strength and Related Properties of Thermally Bonded Polyolefin Geomembrane".
- 3. Daniel, D.E. and R.M. Koerner, (1993), *Technical Guidance Document Quality Assurance and Quality Control for Waste Containment Facilities*, EPA/600/R-93/182.
 - 4. U.S.E.P.A., (1991), *Technical Guidance Document: Inspection Techniques for the Fabrication of Geomembrane Field Seams*, EPA/530/SW-91/051.
 - 5. National Sanitation Foundation (NSF) Joint Committee on Flexible Membrane Liners, (1993), *Standard 54, Flexible Membrane Liners*, NSF International.

E SUBMITTALS

- 1. The Contractor shall submit to IPL's Representative the following information on geomembrane production:
 - a. Manufacturing quality control certificates shall be signed by responsible parties employed by the Manufacturer (such as the production manager).
 - b. The quality control certification shall include, at a minimum:
 - i. Manufacturer's name;
 - ii. product information;
 - iii. roll number;
 - iv. roll dimensions;
 - v. results of quality control tests (as required by the QAM and these Specifications), including a description of the test methods used.

- c. Proposed geomembrane panel layout (at least 7 days prior to mobilization of crews). Once the panel layout is approved, the Contractor may not substantially change the layout without permission of the Authorized Representative.

F. CONSTRUCTION QUALITY ASSURANCE

1. The installation of geomembrane shall be monitored as specified in this section and as outlined in the QAM.
2. The Contractor shall be aware of the activities outlined in the QAM and shall account for these CQA activities in the installation schedule.

PART 2 – PRODUCTS

2.1 MATERIALS

A. GEOMEMBRANE LINER

1. Textured geomembrane liner shall be made of embossed (textured), polyethylene (PE), as noted on the Contract Drawings. Required nominal liner thicknesses shall be 40-mil for both smooth and textured linear low density (LLDPE) geomembrane.
2. LLDPE geomembrane used shall meet, at a minimum, the standards included in GM-17 and the tables at the end of this section.
3. Textured Geomembrane is required on all areas noted on the Drawings. The method and degree of texturing shall be approved by the Geosynthetic QAC. The texturing shall be consistent among rolls and consistent with the samples approved by the Geosynthetic QAC.
4. The chemical resistance of the geomembrane liner shall be in keeping with typical properties of high quality polyethylene products currently available through commercial sources.
5. Geomembrane liner shall be shipped rolled and packaged so as to avoid damage during shipment. Transportation, handling and storage of the geomembrane rolls shall be in accordance with the requirements outlined in the QAM.
6. No reclaimed material (that is, material that has seen previous service) shall be allowed in the Geomembrane sheet.
7. No regrind material (that is, material that has been previously processed but has never seen previous service) shall be allowed in the Geomembrane sheet.
8. The Geomembrane shall be free of pinholes and reasonably free from surface blemishes, scratches and other defects as judged by the Geosynthetic QAC.
9. Each roll of geomembrane shall be identified (in permanent markings) with the manufacturer's name, lot number, roll number, length and width.
10. Manufacturer's Certification documentation shall be provided to the Geosynthetic QAC prior to the material being shipped to the project site. If the results contained in the manufacturer's certifications do not meet or exceed the quality control requirements of these Specifications, the material shall be considered out-of-specification and rejected. At the option of IPL, additional testing may be performed at the manufacturer's expense to "bracket" the portion of the non-conforming materials or to qualify individual rolls. This procedure is valid only when the rolls of material are consecutively produced and numbered from one manufacturing line. To isolate the out-of-specification material, additional samples

may be taken from the rolls that have roll numbers immediately prior to and following the roll that was sampled and failed. If both additional tests pass, the roll represented by the initial failed test shall be rejected. If one or both of the additional tests fail, the material from that lot shall be rejected unless additional testing is approved by the Owner and the Geosynthetic QAC.

PART 3 – EXECUTION

3.1 CONSTRUCTION ACTIVITIES

A. GENERAL

1. A preconstruction meeting shall be held to coordinate the installation of the geomembrane with the installation of the other components of the liner system.
2. The Geomembrane Liner shall be deployed/installed as soon as practical after completion and approval by the Geosynthetic QAC and Contractor of the soil subgrade or portion thereof. Each sequential section of liner shall be secured by sandbags, anchor trench, continuous welding to the adjacent sections, or other method approved by the Geosynthetic QAC.

3.2 GEOMEMBRANE INSTALLATION

A. SURFACE PREPARATION

1. Surfaces to receive liner installation shall be relatively smooth and even, and free of excessively soft or wet soils, ruts, voids, protrusions, and deleterious material. Vehicles leaking contaminants or causing ruts, pumping, or deformation of surface of the soil liner greater than 1.0 inch (25mm) or otherwise unacceptable to the Geosynthetic QAC are not permitted on final dressed surfaces unless authorized by the Geosynthetic QAC and IPL. Any damage to the surface caused by the Contractor's vehicles shall be repaired at the Contractor's expense.

B. ANCHOR TRENCH

1. An anchor trench (as illustrated in the Contract Drawings) will be required at the liner perimeter to secure the Geomembrane. The Contractor shall take precautions to minimize loose soil underlying the geomembrane in the anchor trenches. The time schedule for excavation and backfilling of the anchor trench is to be approved by the IPL so that excessive desiccation of trench soils does not occur prior to backfilling.

C. GEOMEMBRANE DEPLOYMENT

1. Both the Geosynthetic QAC and Geosynthetic Contractor must accept, in writing, the condition of the subgrade prior to the start of the deployment of the geomembrane. The Contractor shall maintain and repair the subgrade as necessary, at no additional cost to IPL, until the final cover has been completed.
2. Unroll only those sections which are to be seamed together or anchored in one day. Panels should be positioned with the overlap recommended by the manufacturer, but not less than 3 in. (76 mm), after the necessary alignment and cutting. The edge of the upslope sheet shall be positioned above the edge of the downslope sheet in a shingle-like fashion. The Geomembrane Liner sections will be placed in an anchor trench which is then backfilled with compacted soil as shown on the Drawings.
3. After panels are initially in place, remove as many wrinkles as possible to the satisfaction of the Geosynthetic QAC. The geomembrane liner shall be allowed to "relax" before beginning field seaming. The purpose of this is to make the edges which are to be bonded as smooth and free of wrinkles as possible.

4. Once panels are in place and smooth, commence field seaming operations, in accordance with the QAM.
5. At the end of each day or installation segment all unseamed edges shall be anchored by sand bags, or other methods approved in advance by IPL. Staples, U-shaped rods or other penetrating anchors shall not be used to secure the geomembrane. Any damage to the liner due to wind, rain, hail, or other weather shall be the sole responsibility of the Contractor.
6. Batton strips shall be utilized to attach the geomembrane to the existing concrete structures (e.g., transmission tower foundations) as directed by IPL.

D. FIELD SEAMING

1. The primary method of field seaming shall be dual track fusion welding. Field seaming may be extrusion or fusion welding or a combination of these methods. Solvent welding of (PE) geomembrane is not acceptable. The Geosynthetic QAC and IPL reserve the right to reject any proposed seaming method believed to be unacceptable. Additional concepts and requirements of proper field seaming include the following:
 - a. All foreign matter (dirt, water, oil, etc.) shall be removed from the edges to be bonded. For extrusion-type welds, the bonding surfaces must be thoroughly cleaned by mechanical abrasion or alternate methods approved by the IPL and the Geosynthetic QAC to remove surface oxidation and prepare the surfaces for bonding. The grinding shall be performed so that grind marks are generally perpendicular to the edge of sheet. No solvents shall be used to clean the Geomembrane Liner.
 - b. Temporary tack welds (if used) shall use heat only; no double sided tape, glue or other method will be permitted.
 - c. The completed liner shall not exhibit any "trampolining" at the time the protective cover is placed over the Geomembrane.
 - d. On sideslopes the seams should be oriented parallel to the line of maximum slope (i.e., oriented up and down) not across the slope. In corners and odd shaped geometric locations, the number of field seams should be minimized.
 - e. No horizontal seams should be within 1.5 m (5 ft) of the toe or the crest of the slope.
 - f. In general, all "butt seams" or "end of roll seams" shall be staggered at least 5 ft on slopes steeper than 5H to 1V, or at the discretion of the Geosynthetic QAC. In addition, butt seams between smooth and textured geomembrane shall be staggered 1.5 m (5 ft).
 - g. No seaming should be attempted above 120°F ambient air temperature. Below 32°F ambient air temperature, preheating of the geomembrane will be required, unless it is demonstrated that this is not necessary (i.e., acceptable trial test (start-up) seams which duplicate actual field conditions). Preheating may be achieved by natural and/or artificial means (e.g., shelters and heating devices). Procedures set forth in GM9 shall be utilized during periods of inclement weather.
 - h. A moveable protective layer of plastic (or rub sheet) may be required, as recommended by the Geosynthetic QAC, to be placed directly below each overlap of geomembrane that is to be seamed, to prevent any moisture build-up between the sheets to be welded. The protective layer must be removed after seaming is complete.
 - i. Seaming will extend to the outside edge of panels to be placed in anchor trenches.

- j. If required, a firm working surface should be provided by using a flat board or similar hard surface directly under the seam overlap to achieve proper support. The working surface must be removed after seaming is complete.
- k. No excessive grinding prior to welding shall be permitted. Overground or improperly ground areas shall be replaced at the Geomembrane Contractor's expense. Grinding shall be performed immediately prior to seaming.
- l. Seams at panel corners of 4 sheets shall be completed with a patch having a minimum diameter of 24 inches which is extrusion welded to the parent sheet. Open ends of all air channels must be sealed.

3.3 GEOMEMBRANE TESTING

All Geomembrane seams will be tested and evaluated prior to acceptance. Testing of the seams shall be conducted by the Contractor under observation by the Geosynthetic QAC. The Geosynthetic QAC or a designated, independent geosynthetics laboratory may perform additional testing, as required by these Specifications or as required in the judgment of IPL and/or the Geosynthetic QAC to verify that the LLDPE sheets and seams meet the specifications. Testing requirements are detailed in the following subsections.

A. CONFORMANCE TESTS

1. Unless otherwise approved by IPL, all conformance testing required by both these specifications and the QAM shall be performed and approved by the Geosynthetic QAC prior to shipping the geomembrane to the project site.

B. TRIAL TEST SEAMS

1. The Contractor shall maintain and use equipment and personnel at the site to perform testing of trial test seams. Test seams will be made each day prior to commencing field seaming. These seams will be made on fragment pieces of geomembrane liner to verify that seaming conditions are adequate. Such test seams will be made at the beginning of each seaming period, at the discretion of the Geosynthetic QAC, and at least once every four hours during continuous operation of each welding machine. Also, each welder/machine combination shall make at least one trial seam test each day of seaming operations. Requirements for test seams are as follows:
 - a. The test seam sample shall be at least 0.9 m (3 ft) long by 0.3 m (1 ft) wide with the seam centered lengthwise. Six adjoining specimens 25mm (1 in) wide each shall be die cut from the test seam sample. These specimens shall be tested in the field with a tensiometer for both shear (3 specimens) and peel (3 specimens). Test seams shall be tested by the Contractor under observation of the Geosynthetic QAC or designated representative of the IPL. The Contractor shall supply all necessary knowledgeable personnel and testing equipment. A passing fusion or extrusion welded test seam shall be achieved when the criteria described in these Specifications are satisfied. Additionally, the specimens shall not fail in the weld. If a test seam fails, the entire operation shall be repeated. If the additional test seam fails, the seaming apparatus or seamer shall not be accepted and shall not be used for seaming until the deficiencies are corrected and two consecutive successful full test seams are achieved. Test seam failure is defined as failure of any one of the specimens tested in shear or peel. For dual track weld seams, both welds shall meet the test seam criteria.
 - b. The Technical Representative shall observe all test seam procedures and shall also log the date, hour, ambient temperature, number and temperature setting of seaming unit, name of seamer, and pass or fail description.

C. NON-DESTRUCTIVE TESTING

1. All production seams shall be tested by the Contractor using non-destructive techniques. The Contractor shall perform all pressure and vacuum testing under the observation of the Geosynthetic QAC or Representative. Requirements for non-destructive testing are as follows:
 - a. Extrusion Weld Seams – The Contractor shall maintain and use equipment and personnel at the site to perform continuous vacuum box testing on all extrusion weld production seams. The system shall be capable of applying a vacuum of at least 5 psi. The vacuum shall be held for a minimum of 10 seconds for each section of seam being tested.
 - b. Dual Track Weld Seams – The Contractor shall maintain and use equipment and personnel to perform air pressure testing of all dual track weld seams. The system shall be capable of applying a pressure of at least 27 to 30 psi. Pressure loss tests shall be conducted in accordance with the procedures outlined in "Pressurized Air Channel Test for Dual Seamed Geomembranes," Geosynthetic Institute Test Method GM-6.
2. Any portion of the geomembrane exhibiting a defect or flaw, or portion of seams failing a destructive or nondestructive test, shall be repaired and non-destructively tested and, if required, destructively tested in accordance with the QAM. The final decision as to the appropriate repair procedure shall be agreed upon between the Project Manager, Installer, and Geosynthetic QAC
 - a. Each repair shall be nondestructively tested as appropriate. Repairs that pass the nondestructive test shall be taken as an indication of an adequate repair.
 - b. Repairs that have been completed by "capping" or overlaying the defective area with identical geomembrane material requiring over 150 linear feet of welding shall require destructive testing.

D. DESTRUCTIVE TESTING

1. Destructive testing shall be performed on an average of every 500 linear feet of production fusion seam and every 400 linear feet of production extrusion seam. The locations shall be selected by the Geosynthetic QAC.
2. Sufficient samples shall be obtained by the Contractor to provide one sample to the archive, one sample to the Geosynthetic QAC for laboratory testing, and one sample to be retained by the Contractor (if requested by the Contractor). Testing requirements are as follows:
 - a. Each sample shall be large enough to test five specimens in peel and five specimens in shear. A passing destructive test must meet the minimum requirements set forth in Geosynthetic Institute Test Method GM-19. All samples must fail in film tear bond (FTB). Samples which do not pass the shear and peel test shall be re-sampled from locations at least 10 feet on each side of the original location. These two re-test samples must pass both shear and peel testing. If these two samples do not pass, then additional samples shall continue to be obtained until the questionable seam area is defined. All initial failing destructive samples shall be bound by subsequent passing destructive tests or the beginning or end of welding.
3. Requirements for destructive testing are as follows:
 - a. All tests shall be performed using a calibrated, motor-driven, strain-controlled tensiometer approved by the Geosynthetic QAC.
 - b. Peel shall be measured for one sample (that is, five specimens). Peel tests shall be performed for each track of the dual track welding machine and evaluated for the criteria described in these Specifications.

- c. Shear shall be measured for one sample (that is, five specimens). Shear tests shall be evaluated for the criteria described in these Specifications.
4. The Geosynthetic QAC, or an independent geosynthetics material testing laboratory approved by the Geosynthetic QAC and IPL, shall perform destructive seam testing for both peel and shear. The Geosynthetic QAC shall evaluate test results in accordance with these Specifications.
5. The Geosynthetic QAC shall be responsible for the archive specimens. He shall assign a number to the archive samples and mark the samples with the number. He shall also log the date, seam number, approximate location in the seam, and field test pass-or-fail description, if applicable. The Geosynthetic QAC shall maintain possession of the archive samples until the CQA Report has been accepted by IDEM. Following acceptance of the CQA Report by IDEM, the archive samples will be discarded.

3.4 REPAIR OF DAMAGED AND SAMPLED AREAS

1. Damaged and sample coupon areas of Geomembrane shall be repaired by the Contractor by construction of a cap strip/patch. No repairs shall be made to seams by application of an extrusion bead to a seam edge previously welded by fusion or extrusion methods. Repaired areas shall be tested for seam integrity. Damaged materials are the property of the Contractor and shall be removed from the site at the Contractor's expense. The Contractor shall retain all ownership and responsibility for the Geomembrane until acceptance by IPL. Maintenance and repair of the geomembrane shall be provided by the Contractor for the duration of the project, at no additional cost to IPL. The Geomembrane shall be accepted by IPL, after the installation and repairs are complete, and after IPL has received documentation for the completion of the installation by the Geosynthetic QAC.

3.5 POTENTIALLY DAMAGING ACTIVITIES

1. No support equipment used by the Contractor shall be allowed on the Geomembrane unless the equipment and protective measures are approved by the Geosynthetic QAC. Light-weight portable generators must be placed on protective rub sheets, and stands or supports shall be adequately padded to prevent potential damage to the rub sheet or Geomembrane. All-terrain-vehicles (ATV's) may only be operated on the Geomembrane if deemed necessary by the Geosynthetic QAC and approved by IPL. If used, an ATV shall have sufficiently low bearing pressure to prevent damage to the Geomembrane. Wheels of ATV's must be thoroughly cleaned to remove stones and other deleterious material prior to operation on the Geomembrane. Personnel working on the Geomembrane shall not smoke, wear damaging shoes, or engage in any activity which damages the Geomembrane.

END OF SUBSECTION

Table for 40 mil Textured LLDPE Geomembrane

Properties	Test Method	Manufacturer's Testing Frequency	Conformance Test Frequency
Thickness - mils (min ave.) Lowest individual for 8 out of 10 values Lowest individual for any of the 10 values	ASTM D5994	1 per roll	1 per roll
Asperity Height mils (min ave.) (1)(2)	ASTM D7466	50,000 sq ft	250,000 sq ft
Asperity Height mils (min ave.) for Agru America Microspike (1)(2)	ASTM D7466	50,000 sq ft	250,000 sq ft
Density (max)	ASTM D1505/D 792	50,000 sq ft	250,000 sq ft
Tensile Properties (min ave.) (3) Break Strength Break Elongation	ASTM D 6693 Type IV	50,000 sq ft	50,000 sq ft
2% Modulus (max)	ASTM D5323	per formulation	N/A
Interface Direct Shear Testing (min.) ¹¹	ASTM D5321	2 per project	2 per project
Tear Resistance (min ave.)	ASTM D1004	50,000 sq ft	250,000 sq ft
Puncture Resistance (min ave.)	ASTM D4833	50,000 sq ft	250,000 sq ft
Axi-Symmetric Break Resistance Strain (min)	ASTM D5617	per formulation	N/A
Carbon Black Content (range)	ASTM D 4218 (4)	50,000 sq ft	50,000 sq ft
Carbon Black Dispersion	ASTM D5596	50,000 sq ft	50,000 sq ft
Oxidative Induction Time (OIT) (min ave.) (6) (a) Standard OIT -or- (b) High Pressure OIT	ASTM D3895 ASTM D5885	200,000 lb	N/A
Oven Aging at 85° (7) (a) Standard OIT (min ave.) - % retained after 90 days -or- (b) High Pressure OIT (min ave.) - % retained after 90 days	ASTM D5721 ASTM D3895 ASTM D5885	per formulation	N/A
UV Resistance (8) (a) Standard OIT (min ave.) -or- (b) High Pressure OIT (min ave.) - % retained after 1,600 hrs (10)	ASTM D3895 ASTM D5885	per formulation	N/A

(1) Of 10 readings, 8 out of 10 must be ≥ 13 mils, and lowest individual reading must be ≥ 10 mils.

(2) Alternate the measurement side for double sided textured sheet.

(3) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.
Break elongation is calculated using a gage length of 2.0 inches at 2.0 in/min.

(4) Other methods such as D1603 (tube furnace) or D6370 (TGA) are acceptable if an appropriate correlation to D4218 (muffle furnace) can be established.

(5) Carbon black dispersion (only near spherical agglomerates) for 10 different views:

* 9 in Categories 1 or 2 and 1 in Category 3

(6) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.

(7) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.

(8) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60 °C.

(9) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.

(10) UV resistance is based on percent retained value regardless of the original HP-OIT value.

(11) Separate tests shall be run on the interface between the geomembrane and the geocomposite, and the geomembrane and the project soil for each set of tests. Tests shall be run at the start of production and the second set at approximately the midpoint of production.

Table for 40 mil Smooth LLDPE Geomembrane

Properties	Test Method	Manufacturer's Testing Frequency	Conformance Test Frequency
Thickness - mils (min ave.) Lowest individual of 10 values	ASTM D5199	1 per roll	1 per roll
Density (max)	ASTM D1505/D 792	50,000 sq ft	250,000 sq ft
Tensile Properties (1) (min ave.) Break Strength Break Elongation	ASTM D 6693 Type IV	50,000 sq ft	50,000 sq ft
2% Modulus (max)	ASTM D5323	per formulation	N/A
Tear Resistance (min ave.)	ASTM D1004	50,000 sq ft	250,000 sq ft
Puncture Resistance (min ave.)	ASTM D4833	50,000 sq ft	250,000 sq ft
Axi-Symmetric Break Resistance Strain (min)	ASTM D5617	per formulation	N/A
Carbon Black Content (range)	ASTM D4218 (2)	50,000 sq ft	50,000 sq ft
Carbon Black Dispersion	ASTM D5596	50,000 sq ft	50,000 sq ft
Oxidative Induction Time (OIT) (min ave.) (4)		200,000 lb	N/A
(a) Standard OIT -or- (b) High Pressure OIT	ASTM D3895 ASTM D5885		
Oven Aging at 85° (5)	ASTM D5721	per formulation	N/A
(a) Standard OIT (min ave.) - % retained after 90 days -or- (b) High Pressure OIT (min ave.) - % retained after 90 days	ASTM D3895 ASTM D5885		
UV Resistance (6)		per formulation	N/A
(a) Standard OIT (min ave.) -or- (b) High Pressure OIT (min ave.) - % retained after 1,600 hrs (8)	ASTM D3895 ASTM D5885		

- (1) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction. Break elongation is calculated using a gage length of 2.0 inches at 2.0 in/min.
- (2) Other methods such as D1603 (tube furnace) or D6370 (TGA) are acceptable if an appropriate correlation to D 4218 (muffle furnace) can be established.
- (3) Carbon black dispersion (only near spherical agglomerates) for 10 different views:
* 9 in Categories 1 or 2 and 1 in Category 3
- (4) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.
- (5) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.
- (6) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60 °C.
- (7) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed.
- (8) UV resistance is based on percent retained value regardless of the original HP-OIT value.

SUBSECTION 02920 – SEEDING

PART 1 – GENERAL

1.1 WORK DESCRIPTION

A. WORK INCLUDED

1. Furnish and install all labor, equipment and materials needed to seed all areas disturbed during this project with the exception of the following areas:
 - a. The areas that are covered by gravel or riprap.

B. RELATED WORK SPECIFIED ELSEWHERE:

1. Subsection 02300: Earthwork

1.2 PRODUCT HANDLING

A. STORAGE

1. Store lime, fertilizer and seed in a dry area.

1.3 ENVIRONMENTAL CONDITIONS

A. SEASONAL REQUIREMENTS

1. Perform the seeding work between February 1 and May 15 or between August 15 and October 15, unless otherwise directed by IPL's Representative, and at such time that the seeding will not be damaged by freezing temperatures, rain or high winds.

1.4 GUARANTEE AND MAINTENANCE

- A. Contractor is advised that he is required to establish and maintain uniform coverage of the specified stand of grasses and legumes for a period of one year following completion of the initial seeding. If during the warranty period, it becomes evident that there are barren or sparse areas within the vegetative cover, or if any particular species is absent or weak, the Contractor shall take all steps necessary to meet the Specifications, at no additional cost to IPL. This shall include the repair of designated erosion areas caused by the failure of the seeding.

PART 2 – PRODUCTS

2.1 MATERIALS

A. COMMERCIAL FERTILIZER

1. Conform to applicable State Fertilizer Laws.
2. Be applied at rates determined through site-specific analysis described in these Specifications.

B. LIME

1. The lime shall be agricultural ground limestone with a minimum total neutralizing value, calcium carbonate equivalent, of not less than 90 percent. At least 40 percent passing a No. 100 sieve and at least 95 percent passing a No. 8 sieve.
2. Be applied at rates determined through site-specific analysis described in these Specifications.

C. GRASS SEED

1. The grass seed shall meet the Specifications outlined in Section 914.04 of the INDOT Standard Specifications. The seed mixture to be utilized in all areas with slopes of less than 3(horizontal):1(vertical) shall conform to the Specifications outlined in Section 621.06(a) of the INDOT Standard Specifications. The seed application rates listed in Sections 621.06 shall be utilized in all areas disturbed in the vicinity of the Ash Pond B.

D. MULCH

1. The mulch shall meet the Specifications outlined in Section 914.05 of the INDOT Standard Specifications.

PART 3—EXECUTION

3.1 NUTRIENT ANALYSIS

- A. All areas to be vegetated shall be tested for nutrient status before the soil amendments are applied and the seedbed prepared. The areas to be vegetated shall be divided into units no larger than 10 acres in size based on similar color, soil type, etc. The Contractor shall collect a minimum of five subsamples from the upper six inches of the topsoil placed in each unit and thoroughly mix the samples to derive one composite sample for each 10 acre (max) unit. The Contractor shall submit the samples to a laboratory that will provide both test results and recommended application rates for both lime and fertilizer. All sampling must be representative of the area to be amended, and the analysis shall be done by a reputable laboratory and/or research facility approved by IPL. A copy of all laboratory data and recommendations shall be provided to IPL's Representative. Based on the results of these tests IPL's Representative will specify the final application rates for the lime and fertilizer. Contractor shall inform IPL's Representative, in writing, of the fertilizer supplier, the proposed formulation to be used and the intended application rate PRIOR to delivery of any material.

3.2 LIME APPLICATION AND SEEDBED PREPARATION

- A. The area to be seeded shall be made smooth and uniform and shall be in accordance with the final grades noted on the Drawing, unless otherwise approved by IPL's Representative. The seedbed shall be loosened to a minimum depth of 6 inches with a disk.
- B. If the site specific nutrient analysis indicates that lime is required, the lime shall be applied as soon as practicable following the spreading of the topsoil and disked into the surface a minimum of six inches.

3.3 APPLICATION OF SEED AND MULCH

- A. The seed and mulch shall be applied in accordance with the Specifications outlined in Section 621.05 of the INDOT Standard Specifications.
- B. The mulch shall be punched or crimped into the soil as specified in Section 621.05(c). In addition, Method A, B or E shall also be utilized to secure the mulch on all slopes steeper than 4(horizontal):1(vertical).

3.4 WATERING

- A. If the Contractor chooses to water the newly sewn grass, he shall be responsible for repairs of any damage to both the final cover soils and the final cover geosynthetics caused by the watering activities. All repairs shall be made in accordance with these Specifications, at no cost to IPL.

END OF SUBSECTION

SUBSECTION 15150 DRAINAGE PIPES

PART 1 – GENERAL

1.1 WORK DESCRIPTION

A. WORK INCLUDED

1. This Work shall consist of the installation of 6 and 12 inch diameter corrugated single-wall HDPE pipe and fittings to serve as perforated drainage pipes and toe drains at locations noted in the Drawings. This Work shall also consist of the installation of the 18 inch corrugated exterior, smooth interior HDPE pipe and 30 inch drop inlets for both the temporary and permanent down drain pipes. The Contractor shall provide all pipe materials and transport and install all backfill materials required for the installation of these pipes and drop inlets in accordance with these Drawings and Specifications.
2. This work shall include the installation of temporary down drain pipes on the south slope of Ash Pond B. As noted on the Drawings, those pipes shall be connected to temporary outlet pipes that discharge near the existing 30 inch outlet pipe near the northwest corner of Ash Pond A”.
3. This work shall include the installation of a portion of two down drain pipe on the west side of Ash Pond C, as noted on the drawings. These down drains will not be fitted with drop inlets during this phase of the closure work. Rather, both pipes will be fitted with water-tight flanges to prevent the release of water and/or ash into this pipes.

B. GENERAL

1. The Contractor shall provide all labor, equipment and tools necessary for the proper installation of the drain pipes.

1.2 JOB CONDITIONS

A. HANDLING MATERIAL INTO TRENCH

1. Use the proper implements, tools, and facilities to provide for the safe and convenient prosecution of the Work.
2. Carefully lower pipe into the trench in such a manner as to prevent damage to materials. Do not dump or drop materials into trench.
3. Trenches shall be kept free of water during the laying of the pipe and until the pipeline has been backfilled.

1.3 SUBMITTALS

- A. Submit Manufacturer's data for all materials.

1.4 QUALITY ASSURANCE

- A. IPL's Representative may reject materials found to have cracks, flaws or other material defects.

PART 2 - PRODUCTS

2.1 PIPE:

1. Pipe and fitting materials for the 6 and 12 inch diameter perforated drainage pipes and/or toe drains shall be high density polyethylene. ADS slotted corrugated single-wall high density polyethylene pipe is preapproved for use on this project. The perforation pattern shall be Type B. Alternative pipe types and diameters may be used if approved in advance by IPL.
2. Down drain pipes shall be HDPE corrugated, smooth interior pipe as noted on the Drawings and shall consist of high density polyethylene that conforms to AASHTO M294 or M252 Type S or SP. The pre-approved source of the down drain pipe and drop inlets is N-12 WT IB Pipe, manufactured by Advanced Drainage Systems. Alternative manufacturers must be approved in advance by IPL's Representative. Connections between pipes shall meet the Manufacturer's Specifications for the selected product. Note that a 30-inch-diameter double manifold may be substituted for the two side-by-side 30-inch-diameter tees (i.e., drop inlets) on the down drains. An Agri Drain Pipe Strap shall be used at all the connections of the 18 inch-diameter pipes.

2.2 GRAVEL BACKFILL AROUND PERFORATED PIPES:

A. PROPERTIES

1. Gravel utilized in the installation of the perforated drain pipe shall be free of any metals, roots, trees, stumps, concrete, construction debris, or any other organic matter or deleterious material.
2. The gravel shall be rounded river gravel and classified as GW or GP in accordance with the Unified Soil Classification System and shall have a maximum of 5 percent passing the No. 200 sieve. The maximum particle size of the gravel shall not exceed 1 inch and the D85 of the gravel shall be at least 0.5 inches.

2.3 BACKFILL AROUND SOLID WALL PIPES

- A. Backfill placed around and to the top of solid wall pipes placed outside the final cover system shall be #11 Coarse Aggregate per 904.03 of the 2014 Indiana Department of Transportation Standard Specifications. Material used to backfill over the pipe shall consist of vegetative materials obtained from the off-site borrow source(s).
- B. The solid wall pipe placed within the limits of the final cover to serve as the permanent down drain pipe for the diversion berms shall be placed directly on the geotextile/geocomposite drainage layer, as noted on the Drawings, before the placement of the vegetative cover soils in the area. The remaining depth above the pipe shall be backfilled with the cohesive soils used to create the vegetative cover. Temporary down drain pipes shall be placed and secured on the ground surface at locations noted on the Drawings. The temporary outlet pipes for the temporary down drains on the south side of Ash Pond B shall be covered with a minimum of 1 ft of soil.
- C. Backfill shall be placed in accordance with all of the Manufacturer's requirements.

PART 3 – EXECUTION

3.1 GENERAL:

- A. Size of the pipes shall be as indicated on the plans. Install as shown in accordance with Manufacturer's recommendations and Section 715 (Pipe Culverts) of the 2014 Indiana Department of Transportation Standard Specifications
- B. After the completion of all work, remove all rubbish, excess material, temporary structures and equipment. Seed and protect all disturbed areas as required to control erosion and restore vegetation.

3.2 LAYOUT

- A. Establish and maintain lines, elevations and general reference points. Verify dimensions indicated in the Drawings. Contact IPL's Representative to review drainage layout locations prior to installation. Any conflicts with pipe installations should be discussed with IPL's Representative, and corrected before continuing the Work.
- B. Locate and mark-out existing underground utilities before performing any excavation or installation. Determine vertical orientation and depths of utilities.

3.3 TRENCHING

- A. The toe drain pipes located along portions of the perimeter of the Ash Pond B final cover system shall be placed in the anchor trench excavated for the geomembrane, as noted on the Drawings. Cross trenches perpendicular to the toe drains shall be excavated for the solid-wall outlet pipes attached to the perimeter perforated pipes. Additional cross trenches and drains may be added as needed per IPL's Representative.
- B. Surface encumbrances, located so as to create a hazard to employees involved in excavation work or in the vicinity thereof at any time during operations, shall be removed or made safe before excavation is begun.
- C. During excavation and installation, material satisfactory for backfilling shall be stockpiled in an orderly manner at a distance from the banks of the trench sufficient to avoid overloading and to prevent slides and cave-ins. Adequate drainage shall be provided for the stockpiles and surrounding areas by means of ditches, dikes, or other approved methods. The stockpiles shall also be protected from contamination with unsatisfactory excavated material, waste material, or other material that may destroy the quality and fitness of the suitable stockpiled material. If the Contractor fails to protect the stockpiles and any material becomes unsatisfactory as a result, such material, if directed by IPL, shall be removed and replaced with satisfactory on-site or imported material from approved sources at no additional cost.
- D. Surface grading shall be done as necessary to prevent surface water from flowing into the excavation, and any water accumulating therein shall be removed so that the stability of the bottom and sides of the excavation is maintained. In wet trenches, dewatering equipment shall be operated ahead of pipe installation and the water level kept below the pipe invert.
- E. Contractor shall remove all excess excavated materials. Excess materials shall be transported and placed at a location identified by IPL's Representative.

3.5 JOINING:

- A. HDPE pipe joints shall be made with split or snap couplings (or other methods approved by IPL's Representative). Standard connections shall meet the requirements of ASTM F405 or ASTM F667. An Agri Drain Pipe Strap shall be used at all the connections of down drain pipes.

3.6 INSTALLATION

- A. The HDPE pipe and all connections shall be installed to conform with the Manufacturer's Specifications and installation instructions.
- B. Install pipe in finished trench commencing at the lowest point, true to line and grade.
- C. Pipe bedding and pipe backfill placed for the perforated toe drain pipes shall consist of the specified washed river gravel. A minimum of 6 inches of the washed river gravel shall be placed along the sides and over the top of the perforated pipe. The gravel shall be covered with a nonwoven geotextile (minimum mass per unit area of 12 oz/sq yd) that is thermally bonded to the cushion geotextile.

- D. Pipe bedding and pipe backfill placed around either 6 or 12 inch perforated drainage pipes located outside the anchor trenches shall consist of the specified washed river gravel. A minimum of 12 inches of the washed river gravel shall be placed along the sides and over the top of the perforated pipe. The gravel shall be covered with a nonwoven geotextile (minimum mass per unit area of 12 oz/sq yd) that is thermally bonded to the cushion geotextile.
- D. Pipe bedding for the portion of the down drain pipes located downslope from the diversion berms and over the geosynthetics in the final cover system shall consist of sand from off-site borrow sources to a depth of 1 ft above the geocomposite. The remaining depth above the pipe excavation (trench) shall be backfilled with the cohesive soils used to create the vegetative cover.

END OF SUBSECTION

**INDIANAPOLIS POWER & LIGHT
PETERSBURG GENERATING STATION
ASH POND B
FINAL COVER CONSTRUCTION**

MAY 8, 2017

Prepared For:

Petersburg Generating Station
6925 N State Road 57
PO Box 436
Petersburg, IN 47567-0436

ATTACHMENTS

Quality Assurance Manual (QAM)
Project Drawings Issued for Bid 05/05/2017

Quality Assurance Manual (QAM)

**Project Drawings Issued for Bid 05/05/2017
(Provided under separate cover.)**

APPENDIX B-3

Crown-Fill Test Pad Evaluation Results

IPL Ash Pond B
12-inch Test Area - CCR Structural Fill - 9/5/17
Field Compaction and Lab Tests

Test Area No.	History	Test No.	Nuclear Gauge Measurement Moisture Content (%)	Lab Moisture Content (%)	Standard Proctor OMC (%)	Standard OMC Minus Lab MC (%)	Average MC Difference from Proctor OMC (%)	Field Wet Density (pcf)	Field Dry Density using Lab MC (pcf)	Standard Proctor MaxDD (pcf)	Percent of Standard Proctor MaxDD (%)	Average Percent of Standard Proctor MaxDD (%)
12-inch Compacted Lift Test Area 2	Dozer Placement plus 2 Roller Contacts (over & back once)	1	8.3	9.4	13.6	4.2	4.2	98.2	89.8	97.1	92.4	91.9
		1A	8.5	9.4	13.6	4.2		97.1	88.8	97.1	91.4	
		2	7.8	8.2	13.6	5.4	5.4	99.0	91.5	97.1	94.2	95.4
		2A	8.4	8.2	13.6	5.4		101.4	93.7	97.1	96.5	
		32	9.9	15.1	13.6	-1.5	-1.5	103.1	89.6	97.1	92.2	92.4
		3A	10.1	15.1	13.6	-1.5		103.4	89.8	97.1	92.5	
1 Pass/ 2 Rolls Average			8.8	10.9		2.7	2.7	100.4	90.5		93.2	93.2
12-inch Compacted Lift Test Area 2	Dozer Placement plus 4 Roller Contacts (over & back twice)	4	8.3	7.7	13.6	5.9	5.9	99.6	92.5	97.1	95.2	94.2
		4A	7.1	7.7	13.6	5.9		97.5	90.5	97.1	93.2	
		5	8.4	8.5	13.6	5.1	5.1	101.0	93.1	97.1	95.9	95.4
		5A	8.8	8.5	13.6	5.1		100.0	92.2	97.1	94.9	
		6	7.4	8.0	13.6	5.6	5.6	97.4	90.2	97.1	92.9	93.0
		6A	7.8	8.0	13.6	5.6		97.7	90.5	97.1	93.2	
2 Passes/ 4 Rolls Average			8.0	8.1		5.5	5.5	98.9	91.5		94.2	94.2
12-inch Compacted Lift Test Area 2	Dozer Placement plus 6 Roller Contacts (over & back thrice)	7	8.1	6.5	13.6	7.1	7.1	98.4	92.4	97.1	95.2	93.6
		7A	8.8	6.5	13.6	7.1		95.1	89.3	97.1	92.0	
		8	8.7	10.1	13.6	3.5	3.5	101.4	92.1	97.1	94.8	93.4
		8A	9.1	10.1	13.6	3.5		98.3	89.3	97.1	91.9	
		9	10.1	9.4	13.6	4.2	4.2	103.5	94.6	97.1	97.4	97.2
		9A	10.7	9.4	13.6	4.2		102.9	94.1	97.1	96.9	
3 Passes/ 6 Rolls Average			9.3	8.7		4.9	4.9	99.9	92.0		94.7	94.7
Average Value			8.7	9.2		4.4	4.4	99.7	91.3		94.0	94.0

DD - Dry Density
MC - Moisture Content
MDD - Maximum Dry Density
OMC - Optimum Moisture Content

IPL Ash Pond B
24-inch Test Area - CCR Structural Fill - 9/5/17
Field Compaction and Lab Tests

Test Area No.	History	Test No.	Nuclear Gauge Measurement Moisture Content (%)	Lab Moisture Content (%)	Standard Proctor OMC (%)	Standard OMC Minus Lab MC (%)	Average MC Difference from Proctor OMC (%)	Field Wet Density (pcf)	Field Dry Density using Lab MC (pcf)	Standard Proctor MaxDD (pcf)	Percent of Standard Proctor MaxDD (%)	Average Percent of Standard Proctor MaxDD (%)
24-inch Compacted Lift Test Area 2	Dozer Placement plus 2 Roller Contacts (over & back once)	1	14.7	10.2	13.6	3.4	3.4	101.3	91.9	97.1	94.7	93.4
		1A	15.3	10.2	13.6	3.4		98.6	89.5	97.1	92.1	
		2	9.3	7.0	13.6	6.6	6.6	97.7	91.3	97.1	94.0	93.5
		2A	11.0	7.0	13.6	6.6		96.5	90.2	97.1	92.9	
		32	9.5	9.2	13.6	4.4	4.4	101.6	93.0	97.1	95.8	95.9
		3A	9.9	9.2	13.6	4.4		101.8	93.2	97.1	96.0	
1 Pass/ 2 Rolls Average			11.6	8.8		4.8	4.8	99.6	91.5		94.3	94.3
24-inch Compacted Lift Test Area 2	Dozer Placement plus 4 Roller Contacts (over & back twice)	4	9.6	10.3	13.6	3.3	3.3	104.6	94.8	97.1	97.7	97.9
		4A	10.1	10.3	13.6	3.3		105.1	95.3	97.1	98.1	
		5	14.9	8.5	13.6	5.1	5.1	100.7	92.8	97.1	95.6	94.2
		5A	14.3	8.5	13.6	5.1		97.8	90.1	97.1	92.8	
		6	10	7.0	13.6	6.6	6.6	95.5	89.3	97.1	91.9	91.3
		6A	9.4	7.0	13.6	6.6		94.2	88.0	97.1	90.7	
2 Passes/ 4 Rolls Average			11.4	8.6		5.0	5.0	99.7	91.7		94.5	94.5
24-inch Compacted Lift Test Area 2	Dozer Placement plus 6 Roller Contacts (over & back thrice)	7	8.5	7.1	13.6	6.5	6.5	96.5	90.1	97.1	92.8	91.6
		7A	11.8	7.1	13.6	6.5		94	87.8	97.1	90.4	
		8	13.6	10.2	13.6	3.4	3.4	102	92.6	97.1	95.3	96.1
		8A	12.4	10.2	13.6	3.4		103.7	94.1	97.1	96.9	
		9	9.9	10.2	13.6	3.4	3.4	101.1	91.7	97.1	94.5	94.7
		9A	10.8	10.2	13.6	3.4		101.6	92.2	97.1	94.9	
3 Passes/ 6 Rolls Average			11.2	9.2		4.4	4.4	99.8	91.4		94.1	94.1
Average Value			11.4	8.9		4.7	4.7	99.7	91.6		94.3	94.3

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